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THE MEANING OF "SERVICE FIRST."

"Service First" means Greater Service, a Greater Number of Subscribers, Greater Harmony and Co-operation, as well as Greater Efficiency.

Physical Connection in Hotels—What Commissions Expect.

Decisions of state utility commissions are carefully scrutinized by officials of telephone companies in order to obtain an idea of the probable trend of decisons in the future. They know that the principles which furnish the basis for the rulings must be understood and probably applied to their own business. It may be that the principles are wrong, but in such cases the courts will discover the sophistry. Fundamental principles must be correct and any business conducted along lines, the fundamentals of which are wrong, will not succeed.

It is for this reason that telephone officials look for the principles underlying the rulings of commissions. The fact that it is the principle which must be considered and followed by telephone companies is pointed out in a recent decision of the Oregon Public Service Commission.

For some years there has been a demand among hotels in cities having competitive systems, for interconnection between the two systems so that one private branch exchange system can be used in the hotels and connections obtained with either city system. In December, 1913, the Oregon Public Service Commission ordered such a connection between the Pacific Bell and the Home telephone companies at the Oregon Hotel, Portland, Ore. The hotel was served, generally, by instruments of the Home company, located in the rooms and operated as a private branch exchange. The Pacific company had a number of instruments installed in the hallways and other semi-public places, which were operated through a private branch exchange switchboard. Trunk lines connected these switchboards with the respective exchanges of the Home and Pacific companies.

A temporary connection was made between the two boards following the issuance of the commission's order. Meanwhile, the case was taken into the district court of the United States in Oregon by the Pacific Bell to vacate the commission's order and enjoin its enforcement. A temporary injunction was denied by the court. The Pacific company thereupon dismissed its suit and provided a more suitable connection for the interchange of calls at the hotel.

Changes in the size of the hotel were made about this time, one of the associated buildings being operated as an independent hotel. The telephone connection arrangement for that part was discontinued and Pacific company instruments were installed in the rooms.

The Pacific company thereupon applied for a rehearing on numerous grounds which practically amounted to a re-opening of the entire case. The commission in passing upon the petition, refused to re-open the case upon the ground that there is nothing in the present record which requires a modification of any part of the original order as to the practicability and public necessity for the interchange arrangement.

In its ruling upon the petition, the commission says: "The conclusion is clear that if a tithe of the ingenuity and skill which has been displayed in attempting to show that the order of the commission was improvident, had been expended in an endeavor to make the best of the commission's order, there would have been no ground for complaint upon the score of any physical or accounting difficulties."

In the same ruling was considered the petition of another hotel for physical connection under conditions similar to those of the Oregon Hotel. Connection was ordered not only for this hotel but also for all other hotels in Portland similarly circumstanced with respect to being provided with dual systems. Thus the Oregon commission reiterates its position in regard to physical connections or interchange of service between competing companies as it relates to hotels.

In its ruling upon this case, the commission observes that: "When a question involving a principle is passed upon, the utilities involved are expected to conform to the principle and

so conduct their operations that it will be unnecessary to make a continuous series of orders to insure the effective application of the public utilities act."

The Oregon commission in connection with the hotel interchange of service cases has therefore taken occasion to tell the telephone companies of Oregon what is expected of them in their relations with the commission.

A Good Move in Iowa.

Beginning this week, the Iowa Independent Telephone Association held the first of a series of district meetings to promote co-operation among the telephone men of the state. As often pointed out, this is a plan which cannot fail to produce good results. Exchange managers and members of their staffs can derive much benefit from such conferences. An exchange of experiences and discussions of plans to improve service and promote closer relations between companies always prove useful to the participants who will return to their work with a new interest and a broader view of their place in every-day life.

We all can learn something from the other fellow. Probably the man highest up the ladder could profit in some way from rubbing elbows with the man whose foot is on the lowest rung. At all events, the former would be none the worse for getting in touch with the viewpoint of his humbler brother. This, of course, is only by way of illustrating how valuable the get-together meetings are, for telephone men—at least in the Independent ranks—are democratic, and all meet on a level.

In organizing by districts, the Iowa association will strengthen itself and enlarge its scope of usefulness to its members.

You Can Always Do Better

By HERBERT KAUFMAN

When you are quite satisfied with yourself you'll begin to dissatisfy the rest of us. No mind at rest can do its best.

There is no end to the Great Road. You can only advance toward perfection—you can never reach it. Real ambition is insatiable; it is a flame to be fed with fresh fuel every day. There is always a higher target for your aim. When you succeed at one task, it simply proves that you are competent to go higher.

The ox cart would never have grown into an automobile, the stage coach would never have become the mile-a-minute express, the oil lamp would never have brightened into the incandescent bulb—if self-complacency had blunted the eagerness of your forefathers.

You don't know what you can do until you try to do it. We are beginning to believe in impossibilities. We are changing our minds about men with visions. They are having a remarkable inning this century. Civilization has seen more improvement in a year than King George beheld in his entire reign.

A new race of giants is in breed—huge-couraged adventurers who dare to dream in full detail, new sciences, industries and empires. The limit of man's power is only to be calculated by the span of his life and the breadth of his outlook.

There is no such thing as complete or lasting perfection. The Hills of Chance constantly offer new peaks. No man ever toiled so far but that he could see a still harder climb in the distance.

Don't wish for the opportunities of your father. Your own are far more countless. The whole continent is still a virgin land. Here and there a few millions of people are packed into cities, foolishly, blindly pushing and striving and struggling—but to the north and to the south and to the west, there are millions and millions of acres calling for exploitation.

The plowshare has stabbed less than one-eighth of the expanse of America. If you live to be as old as Methuselah, striving to do your utmost throughout the centuries, there would be something new still waiting for a pioneer—an unsolved problem for the surgeon—an untried fabric for the weaver—an unthought of project for the engineer—an overlooked opportunity for the merchant.

It is never too late to ascend.

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The Study of Transmission Problems by Means of Vectors

The Uses and Limitations of the Mathematical Treatment—Factors Determining the Quality of Speech Transmission—Graphical Determination of Line Characteristics and Development of Formulae for Attenuation and Wave Length—Reflections

By E. W. Kellogg

The purpose of this article is to show the connection between telephonic speech transmission and the mathematical theory of electric wave propagation, and to develop the theory, as it applies to telephone problems, in as simple a manner as possible.

The telephone art progressed a long way before any attempt was made to apply any mathematical theory to the study of transmission. With a few exceptions the advances have been made by a process of "cut and try," and not by the application of theory. Even today only a small number of the transmission specialists are masters of the mathematics of the problem.

And yet the work goes on.

What good is this abstruse theory?

It has very likely seemed to many that the chief object of the articles that appear from time to time on this subject is to impress the uninitiated with the learning of the writers. Probably a more charitable judgment should be accorded these writers, for their mathematical theory does have a real field of usefulness. The question as to what is the usefulness of the mathematical theory of transmission resolves itself into three other questions:

Usefulness of Mathematical Theory of Transmission.

(1) Can the results of the computations be interpreted in such a way as to throw any light on the practical question of how well a circuit will talk?

(2) Do the calculations throw any light on the question of how to make a line talk better?

(3) Will the study of telephone transmission in a mathematical way be of any help to the practical man who has no desire to become an original investigator?

In regard to the last question it may be said that such a man would rarely meet a problem for which mathematical theory is indispensable. The transmitting efficiencies of different types of standard lines are established beyond the need of much further mathematical demonstration. Tables of transmission equivalents make it possible for a man, without going into any mathematics, to predict the talking qualities of a proposed circuit with a fair degree of accuracy. The value of the theory to the practical man then lies wholly in the fact that it may give a clearer understanding of some of the things that take place in a telephone circuit. While it is by experimentation that improvements are made and defects corrected, a good understanding of theory may suggest lines of experiment, or may eliminate some useless experiments.

The manner in which the mathematical theory bears on the question of the talking qualities of a circuit will next receive consideration. Were speech transmitted by a simple sine-wave alternating current of constant frequency, as is the case with electric power, the matter would be very simple, and the value of a mathematical theory would be unquestioned. But speech is transmitted by highly complex waves of ever-changing forms, and varying in frequency from 100 to more than 2,000 periods per second. Any mathematical study, on the other hand, must confine itself to a pure sine wave of specified frequency. But by calculating the transmission characteristics of the circuit for a number of different frequencies covering the entire range, information is obtained which has much significance in regard to the question of the speech transmitting properties of the circuit. What significance such a series of results would have will be better appreciated after a consideration of what makes a circuit talk well or poorly.

The vowel and consonant sounds that make up words consist of combinations of simple sine waves of different pitch or frequency. Thus, for example, a wave having a frequency of 180 vibrations per second, to which is added a second wave with a frequency of 700 and a third with a frequency of 1,150, produces a certain characteristic sound. All three of these waves may be weakened in the same ratio, and, while the sound becomes fainter, it preserves its character. This happens in an ordinary conversation when the listener moves farther away from the speaker. The sounds are not changed in character, and up to a certain point the words are heard as distinctly as ever.

As the distance is still further increased, the speaker becomes difficult to understand, due to sheer faintness of the sounds. This general weakening of the sound is called "attenuation." Attenuation takes place in most telephone connections; that is to say, the sound given out by the receiver is very weak as compared with the sound produced before the transmitter.

But attenuation is not the only thing, nor even the principal thing in many cases, that sets a limit to telephone transmission. The sounds are more or less altered in character in the process of transformation into electrical waves and back again into sound waves. A loud-speaking telephone does not sound exactly like a human being talking—it is only a sufficiently good imitation so that by giving careful attention the listener can make out what is being said. The actual speaker would be much easier to understand, even though he did not speak nearly so loud as the telephone. A phonograph offers another illustration of this alteration in the character of sounds.

It is not the attenuation or faintness at all in these cases that makes the difficulty, but the change or mutilation of the sounds. "Distortion" is the name generally applied to this action. Were a picture of the waves obtained by means of an oscillograph, or by magnifying the groove in a talking machine record, the sound given out by the receiver would not be found to be a duplicate of the original, reduced somewhat in amplitude, but would appear considerably changed in shape or distorted.

Causes of Distortion.

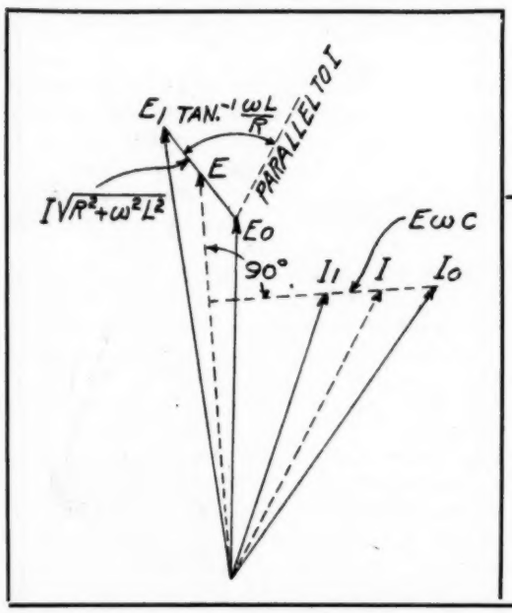
The distortion results from the fact that the telephone is more sensitive to sounds of certain pitches than to others, or transmits them more efficiently. Changes in the phase of the overtones with respect to each other and with respect to the fundamental wave, produce distortion of the wave shape, but experiments seem to indicate that distortion of this nature does not affect the quality of the sound as perceived by the ear.

The best definition of "distortion" for the present discussion is: Inequality in the efficiency of transformation and transmission for sounds of different pitch or frequency. Suppose, for example, that the sounds previously referred to, composed of a set of tones of 180, 700 and 1,150 periods per second, were produced before the transmitter of a loud-speaking telephone set. The instrument would per-

haps reproduce it somewhat as follows: The wave with the frequency of 180 periods per second would be reproduced with twice the loudness of the original; the 700-period wave with four times; and the 1,150-period wave with two-thirds the loudness of their originals.

The fact that all three tones are present in the reproduced wave, makes it presumable that it will sound something like the original, but it can hardly be expected to sound exactly the same. Suppose, on the other hand, that the loud-speaking telephone were capable of magnifying all three of the component waves in exactly the same ratio. Then we should have perfect reproduction, or no distortion.

In ordinary telephone connections no sound waves are reproduced with the full intensity of the originals, but waves of some pitches are weakened more than others. In other words, both distortion and attenuation take place. Either one alone will tend to make the talk at the receiving end more difficult to understand, and the combination of the two is what determines whether the sounds will be intelligible or not. If a long distance line gives rise to a very small amount of distortion, then a much greater degree of attenuation would be permissible than could be allowed if more distortion took place.



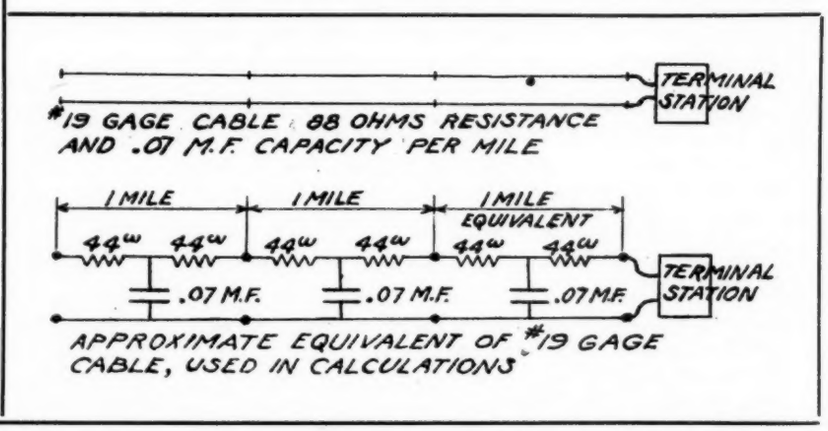


Fig. 1. Change in Current and Voltage in One Mile—Fig. 2. Graphic Representation of Problem with Capacity at ½ Mile Points.

Telephone instruments—transmitters, receivers, induction coils, and other apparatus—are responsible for a certain amount of distortion. No study of speech transmission is complete unless it takes the characteristics of the instruments into account, but in long distance telephony it is in the transmission of the electric currents from one end of the line to the other that the principal distortion and attenuation take place. Therefore transmission theory concerns itself principally with this phase of the problem. The tendency to standardization of substation and switchboard apparatus also throws the emphasis on the study of line characteristics, for with standard terminal equipment the only variables are those resulting from the use of different lines.

The usefulness of mathematics in telephone transmission problems lies in the fact that it is possible to ascertain both the attenuation and the distortion which will take place in the transmission of the electric currents from one end of the line to the other; to show how both of these factors are affected by changes in the resistance, inductance, capacity and leakage of the circuits, and how they will be affected by the introduction of apparatus of various kinds. The formulae which may be developed show how rapidly currents of any given frequency will waste away in transit over a line. They also show how this rate of diminution is affected by each of the line constants and by the frequency.

Lines may be compared on the basis of their rates of attenuation for the same frequency. They may be compared in regard to the distortion they will introduce by seeing whether frequency makes more differences on one line than on the other. For example, on an unloaded No. 19 gage cable line of 0.07 mf. capacity per mile, currents of a frequency of 1,600 cycles per second waste twice as rapidly as currents of 400 cycles, while if the same cable is loaded with medium loading, the high frequency current wastes at practically the same rate as the low frequency current. In other words, loading greatly reduces the distortion.

Thirty miles of standard cable is considered about the limit of satisfactory transmission. What does the traversing of 30 miles of standard cable do to the telephonic currents? A series of calculations, one for each of four or five different frequencies, will serve to show both the attenuation and the distortion that occur. In comparing the current strengths at two points 30 miles apart on a standard cable, a set of calculations shows that the current received, expressed as a percentage of the current sent, is as follows:

Frequency	Current Received
400	9.8 per cent.
800	3.8 per cent.
1,200	1.9 per cent.
1,600	0.95 per cent.

Tests by actual talking are the final criteria in all transmission studies. Mathematical calculations are dependable only so far as talking tests show them to be. But many general principles have been established by the help of mathematics which would hardly have been discovered by talking tests alone, and mathematical comparisons have been found trustworthy in ways that would hardly have been anticipated.

Fortunately a very good indication of how well a circuit will talk can be had by making a single calculation, using a mean value of frequency, of about 800 cycles per second. It has been found by repeated trials that, when two circuits show the same degree of attenuation for currents of this frequency, they will talk about equally well, even though they may differ somewhat in the kind of distortion which they introduce. This may be explained by saying that 800 is something like a balance point, the frequencies above and those below 800 being of about equal importance to speech. Of two circuits which transmit 800-cycle current with equal efficiency, one circuit may be more wasteful of the high frequency currents but transmit the

low frequency currents better than the other circuit, and the two effects balance, so that while the character of the speech transmitted over the two circuits may differ, the talk is, on the whole, equally good.

In working problems in electric circuits of this nature, it is common to begin at the terminals of the receiving apparatus, and work back toward the source, tracing the changes in current and voltage step by step. The impedance and phase angle of the receiving apparatus must be known. A certain current, say one milliampere, may then be assumed to flow through the receiving apparatus, and the magnitude and phase of the voltage follows. The current in the line a short distance toward the source, say one mile from the receiving station, can be found by adding the current required to charge the condenser formed by the intervening mile of line, to the current taken by the receiving apparatus. This must be a vectorial addition, for the charging current is not in phase with the receiver current. Likewise the voltage a mile from the receiving station may be found by adding together vectorially the receiver voltage and the voltage required to overcome the resistance and inductive reactance of the mile of circuit. When the voltage and current a mile from the end of the line are found, another similar step will determine the voltage and current at the two mile point, and so on.

In Fig. 1 E_0 and I_0 stand for the voltage and current respectively at the end of the line and E_1 and I_1 stand for the voltage and current one mile from the end. E_1 differs from E_0

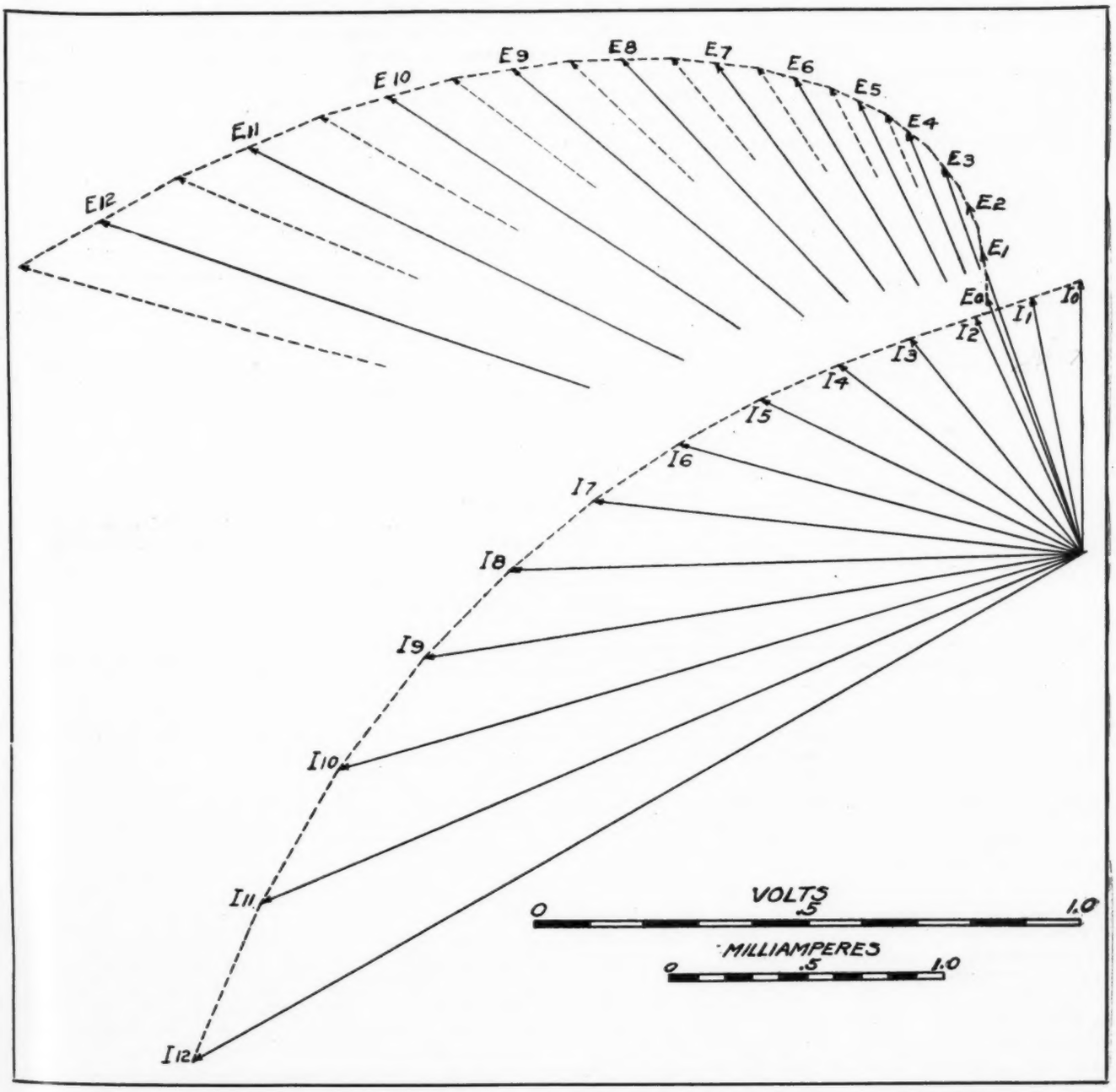


Fig. 3. Vectors of Voltage and Current, at Various Distances from Receiving Station, by Graphical Construction.

by the amount $I\sqrt{R^2+\omega^2L^2}$ which is a vector laid off ahead of the I vector by the angle whose tangent is $\frac{\omega L}{R}$ where R is the resistance and L the inductance of one mile of circuit, and $\omega=2\pi\times$ frequency. The current to use in this operation is neither I_0 nor I_1, but a mean between the two, for the current changes gradually from one value to the other in this mile of circuit. Likewise the charging current, which is equal to ωCE and is 90 degs. ahead of the E vector, should be based on a

voltage between E_0 and E_1, as indicated by the dotted vector in Fig. 1.

If the sections were taken very short, this slight difference in the voltage could be disregarded in finding the charging current, and the slight change in current could be disregarded in finding in impedance drop in one section. The matter is treated in this way when it is handled by calculus. For working out the problem graphically step by step it is best to consider the capacity as concentrated at the half-mile points as shown in Fig. 2. This makes the voltage acting on the condenser practically a mean between E_0 and E_1 and thus gives about the right charging current for the first mile. It finds the impedance drop for the first mile by considering I_0 as flowing in the first half mile, and I_1 as flowing in the second half-mile.

In Fig. 3 is shown a set of vectors of current and voltage worked out in this manner for a No. 19 gage cable, having a capacity of 0.07 mf. per mile, 88 ohms resistance per loop-mile, and negligible inductance and leakage. The receiving apparatus is assumed to have an impedance of 500 ohms, with the current lagging 20° behind the voltage. The frequency is taken as 800 cycles per second. The distances from the receiving station are indicated by the subscripts of the vectors.

It will be noticed in Fig. 3 that 12 miles from the receiving station the current is leading the voltage by about 45 degs. and that the ratio of voltage to current is 505. Were the line cut at this point and its impedance measured, this would be found to be 505 ohms.

Beyond this point, as we go still further from the receiving station, we find that this phase angle between the voltage and current remains constant, and that the ratio of voltage to current or the impedance remains constant, both voltage and current increasing each mile, as the source of the energy is approached, in the ratio 1.132:1. Both the current and voltage vectors also advance in phase by 7.2 degrees with each mile. Then to find the current 12 miles nearer the source, it would be unnecessary to continue making the calculation step by step, but simply to increase the length of the vector in the ratio $(1.132)^{12}=4.42$, and to advance it in phase by $12\times7.2°=86.4°$.

The reason that it was necessary to go some distance from the receiving station before the relation of voltage to current became constant, will be discussed later. The true characteristics of the line are best shown when the receiving apparatus is far enough away so that its influence is lost. Under these conditions, as we have seen, the impedance is constant, the voltage and current undergo a uniform change in phase per mile and change in magnitude each mile in a certain ratio.

Transmission problems nearly always involve the operation of finding the phase and magnitude of the current or voltage at one point, when the current and voltage at some other point a given distance away are known. Finding the total change in phase is a very simple matter. If the distance is l miles and the change in phase per mile is $\Phi°$, then the total change is $l\Phi°$.

To find the total change in magnitude, however, is not so easy. If I_0 is the current at the known point, I_L the current l miles toward the source, and r is the change in magnitude per mile, expressed as a ratio, then $I_L=I_0r^l$. The use of logarithms greatly facilitates the raising of r to the power l. Let a stand for the logarithm to the base ϵ of r, then $a\,l=\log_\epsilon r^l$. Then equation for current strength then becomes $I_L=I_0\times\epsilon^{al}$.

If we wish to find the current at a point l miles from the reference point measured *away* from the source, the equation holds by calling l negative when measured in this direction. Multiplying I_0 by ϵ^{-al} is equivalent to dividing it by r l times.

Let us consider for a moment what is the physical meaning of these changes in the positions and lengths of the vectors. Each current vector represents an alternating current of a certain strength and frequency and in a certain phase relation to the others. The vectors for points farther from the source are behind those for points nearer the source and are also shorter. This means that the current, say 25 miles from the source, would be weaker than that 20 miles from the source and would reach its maximum slightly later. That is what happens when a wave passes, whether that wave is electrical, a sound wave, or a wave on the surface of a body of water. The rise and fall of the surface of the water at a point 150 feet from the source of the wave occurs a little later than it does at a point only 140 feet from the source. It is also slightly less violent at the greater distance. The high frequency currents supplied to the line by a transmitter do not at once reach the receiver, but if the line is long, they are entirely taken up by the line capacity and are carried along to the receiver as a series of waves.

The change in direction of the vector in a mile gives an indication of the velocity of propagation. If one mile makes a difference in phase of $\Phi°$, it would take $360\div\Phi$ miles to make a phase difference of 360 degs. or one cycle, or in one cycle, the wave would travel $360\div\Phi$ miles. In one second or f cycles, the wave would travel $f\times360\div\Phi$ miles. In the case of the No. 19 gage cable previously described, a wave length for a current of 800 cycles would be $360\div7.2=50$ miles. Since the wave travels 800 wave lengths per second, the velocity of propagation would be $800\times50=40{,}000$ miles per second.

(To be concluded)

B. & O. Extends Telephone Train Dispatching.

Telephone dispatching was adopted on the Ohio division of the Baltimore & Ohio Southwestern Railroad recently, on the main line between Cincinnati and Parkersburg. With the completion of this work there are now about 1,000 miles of this company's lines over which trains are dispatched by telephone. The telephone system is in use in the Southwestern district on the lines from Cincinnati to Seymour, Ind., and from Seymour to Louisville.

On the Eastern lines the telephone is used from Cumberland to Brunswick, Johnstown to Rockwood, Connelsville to Fairmont, Fairmont to Clarksburg, Grafton to Parkersburg and Wheeling, Wheeling to Pittsburgh and Newark, and also on the Staten Island Railway. Even where trains are operated under the manual or other block system the telephone is used to expedite movements and affords additional safety.

Plans for District Operators' Meeting at Paris, Ky.

Preparations are being made by J. J. Veatch, district manager for the Central Home Telephone & Telegraph Co., at Paris, Ky., for a district operators' meeting to be held at the Hotel Windsor, on the afternoon and evening of October 30. The company will provide for the supper to be spread at the hotel and will arrange for all other matters of entertainment. In addition to the representatives from the various exchanges of the company in the district, the chief operators and managers of the various connecting exchanges in the section have been invited to attend and are expected to be present. Chief operators at eight of the exchanges in the district are on the program for discussions while the headquarters office at Louisville will be represented. This will be Halloween and special recognition of that fact will be taken in arranging for the entertainment of the employes and guests.

Annual Convention of Ohio State Association.

At a meeting of the board of directors of the Ohio Independent Telephone Association, held at Columbus, October 13, it was determined to hold the annual convention of the association on Thursday and Friday, November 18 and 19, at the Hartman Hotel, Columbus, Ohio.

From all indications this convention will be largely attended and an interesting program will be arranged. A general invitation is extended by the association to all interested in the Independent operating field as well as to those interested in the manufacturing of apparatus and supplies.

Bell Must Connect With Independent Systems in Hotels

Oregon Commission Reiterates Its Stand in Original Ruling in Oregon Hotel Case, in Which It Ruled That the Pacific Telephone & Telegraph Co. Must Provide for Interconnection in All Portland Hotels Having Dual Systems

The Oregon Public Service Commission, on October 4, handed down a ruling on the petition of the Pacific Telephone & Telegraph Co. for a rehearing of the case of the Wright-Dickinson Hotel Co., et al vs. the Pacific Telephone & Telegraph Co. and the Home Telephone & Telegraph Co. of Portland and also in the case of L. Q. Swetland et al vs. the Pacific Telephone & Telegraph Co., the two cases having been consolidated by the commission for hearing and disposed of in a single order.

History of the Case

The original order in the case of the Wright-Dickinson Hotel Co. vs. the Pacific Telephone & Telegraph Co. and the Home Telephone & Telegraph Co. was made December 5, 1913, and is set out in full in the annual report of the Oregon Railroad Commission for 1913, page 127.

Both the Pacific and Home companies maintain local exchanges within the city of Portland. The Pacific company owns and operates telephone and telegraph lines generally throughout Oregon and adjacent states, and does both a local exchange and an inter-exchange or toll telephone business. Its local exchange system is manual in operation and that of the Home Telephone & Telegraph Co. is an automatic system. The Home company has connection with the toll lines of the Northwestern Long Distance Telephone Co., from Corvallis via Portland to Tacoma and Seattle.

The plaintiff, the Wright-Dickinson Hotel Co., operates the Oregon Hotel in the city of Portland. At the time of the making of the original order the Wright-Dickinson Hotel Co. operated together what now constitutes the Oregon and the Benson hotels. At the time the order was entered the situation was that the Oregon Hotel as then constituted was generally served by instruments of the Home company located in the rooms, and operating through a private exchange. The Pacific company under a contract with the Wright-Dickinson Hotel Co. had installed a smaller number of telephones in the hotel, located in hallways and other semi-public places, with telephone booths in the hotel lobby, all operated through a private branch exchange switchboard. The switchboards of the Pacific and Home systems were connected by trunk lines with the exchanges of the respective systems.

The order previously entered in this case required connection of the switchboards of the Pacific and Home companies in the Oregon Hotel so that telephone traffic could be interchanged between the Pacific company's system and the various telephones of the Home company's system located in such hotel; that the expense of making the connection should be borne by the hotel company, and the expense of maintaining the same equally by the telephone companies. It was found that a reasonable compensation to be paid to the Pacific company by the hotel company for the service performed was 3⅓ cents for each call going out from the hotel transferred from the switchboard of the Home company to that of the Pacific company, in addition to the sums received by the existing contract between the Pacific company and the Wright-Dickinson Hotel Co. for the private branch exchange service.

Upon the making of the order a temporary connection was effected between the two boards.

Proceedings were brought by the Pacific company in the district court of the United States in the district of Oregon to vacate the order and to enjoin its enforcement. A temporary injunction was denied (The Pacific Telephone & Telegraph Co. vs. Wright-Dickinson Hotel Co., 214 Federal 666). Thereupon the plaintiff dismissed its suit.

A more suitable physical arrangement was thereupon made for the interchange of calls between the two switchboards. About this time the Benson Hotel, which had been disassociated from the operation of the premises now known as the Oregon Hotel, discontinued the arrangement called for by the order and installed Pacific company telephones in its rooms.

Petition for Rehearing of Case.

The rehearing sought by the Pacific company on numerous grounds, amounted practically to the reopening of the entire question. Except for the fact that the Oregon Hotel is now smaller than when the order was originally made, the commission found nothing in the present record which required a modification of any of the findings made in the original order as to the practicability and public necessity for the interchange arrangement previously ordered. In making this finding the commission was not unmindful of the fact that by decree of the United States district court, the long distance lines of the Pacific company are now open to subscribers of the Home company, and the toll lines of the Northwestern Long Distance Telephone Co.'s system are open to the patrons of the Pacific company.

It was assigned by the Pacific company as a reason for vacation of the order that the privileges afforded by the order have been abused both by the hotel company and the Home company in that proper account has not been made by the hotel company for outgoing calls, and that the Home company has used the order as a pretext for making unauthorized physical connections between the two systems at places other than the Oregon Hotel.

The record in this case did not show to the commission's satisfaction that there has been a wilful abuse of the commission's order by the hotel company. It is apparent, the commission states, that by very simple means, such as are now employed in numerous cases, the Pacific company is in a position absolutely to insure a full measurement of all interchanged calls. The conclusion is clear that if a tithe of the ingenuity and skill which has been displayed in attempting to show that the order of the commission was improvident had been expended in an endeavor to make the best of the commission's order, there would have been no ground for complaint upon the score of any physical or accounting difficulties. The commission's order was predicated upon the rendition of proper accounts between the parties and payment of the same by the subscriber to the utility, and if full compensation is not made by the hotel company for service performed by the Pacific company under the order of the commission, an appropriate order for the relief of the Pacific company can be made hereafter on proper showing.

It appeared that the Home Telephone & Telegraph Co. has installed devices in a large number of places beside the Oregon Hotel and other institutions of a similar character, which permit the interchange of telephone calls

between the Home company station sets and the system of the Pacific company, through trunk lines reaching from the Pacific company's exchange to the premises of the subscriber. The Home company has filed a schedule with the commission fixing a monthly charge for the use of such devices.

Such interchange of traffic, the commission holds, is in clear violation of the rights of the Pacific company, and compels that company involuntarily to violate its schedules filed with the commission. Unwittingly, patrons of the Home company who accept service for the Pacific company's system under such an arrangement are guilty of a violation of law. The Home company should remove all such devices except in the case of hotels similarly circumstanced to the Oregon Hotel, at once, and should hereafter install no other device of the same character for the purpose of permitting an interchange of traffic with the Pacific company's system without the consent of the commission or the Pacific company, and only in compliance with schedules properly filed with the commission or pursuant to its order.

In Case UF-22 the plaintiff, Wright-Dickinson Hotel Co., objects to the charge of 3⅓ cents for each outgoing call from the Home company's switchboard through the switchboard of the Pacific company.

The record in the present case does not change the opinion of the commission in its original order that such charge was reasonable. To avoid misunderstandings which have occurred, it was the intent of the commission that the 3⅓ cents for interchanged calls should apply only to what was known as completed calls, and not to calls which, by reason of inability of the Pacific company to reach the called subscriber or otherwise, do not result in a completed telephone conversation. Nor should the 3⅓-cent charge be made when a greater charge is collected, as for long distance service.

The complaint in UF-127 is brought by Lot Q. Swetland and others against the Pacific company. The record shows that the complainants are interested in the operation and management of the Perkins Hotel in the city of Portland, and that the circumstances and conditions surrounding the operation of that hotel are substantially the same as in the case of the Oregon Hotel; that the complainants were desirous of having extended to them the same privilege of interchange of traffic between the Home telephone stations located in their hotel and stations of the Pacific company reached over Pacific trunks, and the Pacific company denied such privilege. For the reasons set out in the original order and in this order, it was found that a reasonable service and facility for the Pacific company to afford in the premises is to permit a connection to be made between its lines at the Perkins Hotel in the city of Portland, and thereafter to interchange traffic, as has been and is being done at the Oregon Hotel. It was found by the commission that failure to afford the Perkins Hotel, and other hotels within the city of Portland, which have Home Telephone & Telegraph Co. equipment, and also Pacific Telephone & Telegraph Co. equipment, the same facilities for interchange of traffic which have been required by this commission in the case of the Oregon Hotel, constitutes an unjust discrimination. In passing the commission makes the observation that when a question involving a principle is passed upon, the utilities involved are expected to conform to the principle and so conduct their operation that it will be unnecessary to make a continuous series of orders to insure the effective application of the public utilities act.

The commission therefore ordered that the Pacific Telephone & Telegraph Co. shall afford to the complainants in Case UF-127 the same facilities with respect to the interchange of traffic, and upon the same terms, at the Perkins Hotel as are now afforded to the Wright-Dickinson Hotel Co., at Oregon Hotel; and shall afford to all other hotels in the city of Portland similarly circumstanced with respect to being provided with dual systems, the same facilities and upon the same terms, without further order of this commission; and shall embody in a schedule to be filed with the commission and published as required by law and the rules of this commission, the rules and rates hereby prescribed; and that the Pacific Telephone & Telegraph Co. shall cease and desist from the unjust discrimination hereinbefore found, and shall afford the service heretofore found to be reasonable, upon the terms already prescribed.

It is further ordered by the commission that the Home Telephone & Telegraph Co. shall immediately remove all equipment which is designed to permit the interchange of traffic between the Home Telephone & Telegraph Co.'s lines and those of the Pacific Telephone & Telegraph Co. upon the premises of individual subscribers, except in such cases as are covered by this order, and shall not install any such equipment thereafter for such purposes except with the consent of the Pacific company, and upon the further order of this commission.

This order is to become effective November 1, 1915. In other respects the petitions for rehearing are denied.

To avoid misunderstand the commission states that this order is predicated upon the particular state of facts shown in the record herein, and the circumstances surrounding the particular character of business transacted by the complainants in these cases, and therefore is not necessarily a controlling precedent in other cases where the facts are different.

Investigation of Home T. & T., of Portland, Ore.

The Oregon Public Service Commission has, on its own motion, investigated the rates, tolls and charges of the Home Telephone & Telegraph Co., of Portland, within the state of Oregon, and has also investigated the company's rules, regulations and practices with reference to the furnishing of such service.

After making such an investigation the commission has determined that sufficient grounds exist to warrant a hearing being held to determine whether the existing rates, charges, tolls, regulations, practices, and services of the Home company are just, reasonable, adequate, non-discriminatory, or whether they are in any respect in violation of law.

Accordingly, on October 4, the commission ordered that the further investigation be had as to the matters previously enumerated, to the end that if after such investigation it shall develop that any, or all of such rates, charges or regulations of the Home company are unjust, unreasonable, inadequate, unjustly discriminatory, or otherwise in violation of law, the commission fix and determine just, reasonable, adequate, non-discriminatory and lawful rates, tolls, charges, services, and regulations and practices, which the company will be required hereafter to substitute in lieu of any so condemned.

Following is a word-diagram of the investigation as laid out in the order of the Oregon Public Service Commission under Schedule A:

PART I.—GENERAL.

(a) Exchange rates in effect; compilation of group exchanges, classified by present rates. (b) Rate practices of the company. (c) Reason for developing basic principles for proposed rates; historical resume of the development of exchange rate schedules.

The rates and practices pertaining to the individual head-

ings in the following outline of the investigation which is to be made, are discussed under each heading in reference to the particular subject.

PART II.—EXCHANGE RATES.

1. Preliminary classification of exchanges to facilitate: (a) Elimination of inconsistences in existing rate schedules; (b) scope of problem in determining consistent schedules.
2. Determination of proper grouping of exchanges to permit: (a) Elimination of inequalities in rate schedules; (b) rate schedules uniform and consistent for each group of exchanges.
3. Prime factors involved in determining consistent schedules: (a) Kinds of service to be rendered in the various groups of exchanges; (b) range of differentials in rates: (1) Between schedules for various groups of exchanges; (2) between business and residence service; (3) between classes of service under—(a) business rates. (b) residence rates.

(c) Establishment of exchange boundaries and scope of local service for each central office district; (d) determination of primary rate areas for each exchange; (e) application of the principle of foreign and excess mileage and rates therefor; (f) governing schedules covering the rules, regulations and practices of local exchange rate schedules.

Some of the important items to be considered in connection with the rates are:

1. Advance payments.
2. Applications for service.
3. Attachment charges—farmer lines.
4. Auxiliary lines and stations.
5. Business and residence rates, application of.
6. Discounts.
7. Extension stations.
8. Intercommunicating systems.
9. Interior systems.
10. Directories and listings.
11. Pole line construction charges.
12. Private branch exchange service.
13. Local ordinance considerations.
14. Public telephones.
15. Moving charges.
16. Renewal of message rate contracts.
17. Short term service.
18. Superseding contracts.
19. Supplemental equipment.
20. Suspending residence service.
21. Termination of contracts.
22. Transfer of contracts.
23. Cities, villages and localities served, list of.
24. Designation of central office districts.
25. Explanation of terms.
26. Farmer line rates.
27. Population—area.

4. Study of operating expenses as related to plant, traffic and commercial.

PART III.—DEPRECIATION.

Basic principles and reasons therefor.

PART IV.—GENERAL RELATIONS.

(a) Company relation; (b) connecting company relations.

Under Schedule B the Home Telephone & Telegraph Co. is required to furnish the commission, within 60 days of the date of the order, information and statements relative to capitalization, intercorporate relations, value of property, earnings and expenses during 12 months ending June 30, 1915, fixed charges during the 12 months ending June 30, 1915, and general balance sheets of the company's business as of June 30 of each year since the incorporation of the utility.

Earnings of American Telephone & Telegraph Co.

Gross earnings of $34,769,035 are shown by the American Telephone & Telegraph Co. for the nine months ending September 30, 1915. Deducting $4,181,120 for expenses, net earnings for the nine months total $30,587,914, compared with $30,490,430 for the corresponding period of 1914. Dividends amounting to $21,592,194 were paid during this period, leaving a surplus of $3,946,336.

The Bell telephone system for the eight months ended August 31, 1915, earned $156,750,415, compared with $149,669,237 the corresponding period last year. After deducting the $113,955,873 total expenses, net earnings amount to $42,794,542 for the period, comparing with $38,903,954 a year ago. Dividends were slightly higher, $21,568,279 being paid out, leaving $8,944,877 surplus earnings, compared with $6,078,820 last year.

The earnings statement of the A. T. & T. Co., for the nine months ended September 30, 1915, is as follows:

	1914.	1915.
Dividends	$18,922,626	$18,935,356
Interest and other revenue from associated companies	10,671,379	10,101,222
Telephone traffic (net)*	4,223,279	4,825,774
Other sources	785,629	906,682
Total	34,602,914	34,769,035
Expenses	4,112,484	4,181,120
Net earnings	30,490,430	30,587,914
Deduct interest	6,241,562	5,049,384
Balance	24,248,867	25,538,530
Dividends paid	20,679,164	21,592,194
Balance	3,569,703	3,946,336

*One month estimated.

The comparative statement of earnings for the entire Bell system for the eight months ended August 31, 1915, is as follows:

	1914.	1915.
Gross earnings	$149,669,237	$156,750,415
Expenses		
Operation	54,278,573	55,597,689
Current maintenance	21,230,968	20,312,329
Depreciation	27,176,026	29,356,874
Taxes	8,079,716	8,688,981
Total expenses	110,765,283	113,955,873
Net earnings	38,903,954	42,794,542
Deduct interest	12,547,139	12,281,386
Balance net profits	26,356,815	30,513,156
Deduct dividends (paid for six months and estimated for two months)	20,277,995	21,568,279
Surplus earnings	6,078,820	8,944,877

Earnings of Keystone Telephone Co.

The Keystone Telephone Co., of Philadelphia, Pa., has issued its comparative statement of earnings for the combined companies for the month ended September 30, 1915 and for the nine months ended September 30, 1915, as follows:

	For Month Ended		For Nine Months Ended	
	Sept. 30, 1915	Year Previous	Sept. 30, 1915	Year Previous
Gross earnings	$114,993	$111,135	$1,014,147	$991,397
Operating expenses and taxes	56,789	54,363	503,981	487,815
Net earnings	58,204	56,772	510,166	503,582
Less interest charges	26,907	26,119	239,380	233,972
Net surplus	$ 31,297	$ 30,653	$ 270,786	$269,610

War Bonuses to Telephone Employes.

The matter of war bonuses is beginning to trouble some of the telephone employes of England. At Stockport the local branch of the Amalgamated Society of Telephone Employes has sent a resolution to the postmaster general urging that a war bonus granted for March 1 last, be paid.

"Telephony's" Home Study Course for Telephone Men

A Complete Presentation of the Principles Underlying Modern Telephony in All Its Branches—Arranged Systematically So That Regular Reading and Faithful Study Will Qualify Ambitious Men for Higher Positions—Prepared Under Supervision of Stanley R. Edwards—This Section Written by Jay G. Mitchell

Quiz Questions on the Preceding Installment.

202. Why is the resistance of the common battery line circuit relatively more important than the resistance of the magneto line circuit?

203. What is the function of the battery feed reactance coils in the connecting circuit at the central office?

204. What is the principal function of the condensers placed in the central office connecting circuit?

205. What are the factors that determine the strength of the current feed out to the subscriber's telephone instrument?

206. Why will a short line always receive a greater strength of current than a longer one of the same kind of wire?

207. How does current divide when flowing into two circuits of different resistances from a source of constant voltage?

208. Why is it desirable to equalize, as far as possible, the battery feeds to all subscribers' telephone circuits?

CHAPTER XI. The Common Battery Line Circuit (Cont'd).

209. *Effect of condensers in circuit.*—It is clear that the use of the condensers materially reduces the variation in the current supply to lines of widely different resistances. In other words, their use insures more current to the long line and less to the short one. There are other reasons connected with the signaling and supervision of the connection that call for the use of the condensers, or *some other means,* for separating the battery feed to the two stations of a telephone connection between different lines. These other reasons will be taken up in due time in connection with the study of common battery signaling principles.

A variation that is permitted by the arrangement of some central office switchboards is shown in Fig. 86. The effect is practically the same as the effect of the arrangement shown in Fig. 85 as to the matter of battery current supply to the telephone circuits. One advantage claimed for this arrangement is that both battery feed windings are dependent upon the same magnetic circuit for their magnetic field. In other

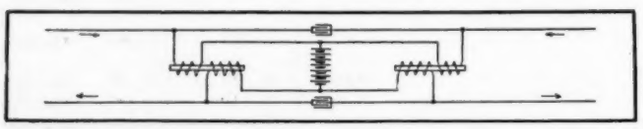


Fig. 86. Double Wound Reactance Feed.

words, the claim is made that the impedance of the coil in the positive side of the battery circuit *must* have exactly the same value as the impedance of the coil in the negative side of the battery circuit.

While this is practically true, there are conditions which detract somewhat from the strict accuracy of the statement. *Practically speaking,* these two coils on the same core *have* the same impedance, but since the core is ordinarily used for the core of the supervisory relay, the air gap and position of the coils on the core introduce some differences. The arrangement

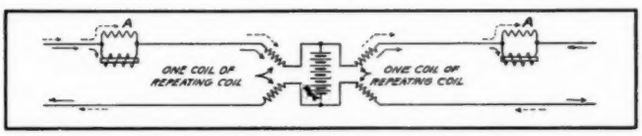


Fig. 87. Repeating Coil Battery Feed.

shown is probably the most satisfactory in this respect. For perfectly obvious reasons it is always advisable to maintain an equality in this respect between the two battery feed coils on the same end of the connection as far as possible.

210. *Repeating coil type of circuit.*—In Fig. 87 is shown the repeating coil form of connecting circuit. In this arrangement the two parts of the connection are supplied with battery through the two windings of a repeating coil. The repeating coil acts as an alternating current transformer, sending the induced alternating telephonic voice currents on to the other station without any increase or decrease in voltage. This is because the two windings of the repeating coil have exactly the same number of turns and the same magnetic circuit. It will be remembered that the other form of transformer used in telephony, the induction coil, had a great many more turns in its secondary winding than in the primary. The effect therefore, was to step the voltage up.

The repeating coil in the connecting circuit shown, is not intended to affect the voltage of the current. It is intended solely to separate the two ends of the telephone circuit for the battery feed. The path of the direct current battery feed is shown by the solid arrows. The dotted arrows show the path of the telephonic voice currents.

In the negative side of the battery feed and telephone circuit is placed a relay, as shown, for the purpose of enabling the operator to supervise the connection. Since this relay is directly in the circuit carrying the telephonic voice currents, it must not be inductive. Therefore the winding is provided with a non-inductive winding *A* through which the high frequency telephonic voice currents will pass without serious interference. The ohmic resistance of this non-inductive shunt is higher than that of the winding of the relay. This insures the passage of the greater part of the direct current battery supply through the relay winding and affords a method of supervising the connection.

211. *Low resistance.*—Aside from the function of carrying the transmitter supply current from the central office, the

common battery line circuit is subject to the same requirements as the magneto or local battery line circuit. In both, low resistance is a very desirable condition.

In the common battery circuit, it is much more essential that the resistance be kept low than in the case of the magneto line circuit. This is because of the composite nature of the current flowing over the common battery line circuit. In the magneto line, the current carried, except when signaling, is the alternating voice-carrying current only. In the common battery line circuit, the voice-carrying currents must be carried over the wire and, in addition, the much stronger direct current required for the proper operation of the transmitter.

Let us assume that the strength of the voice-carrying current, such as flows over a magneto line circuit, is 0.001 of an ampere. It would not be far from reasonable to assume for the strength of the composite current on the common battery circuit, a value of 0.1 of an ampere. If we should consider that this current in each case was required to be produced in a telephone circuit measuring 1,000 ohms in resistance, it will illustrate the point to determine the voltages required in the two cases.

In the case of the magneto line circuit of 1,000 ohms, a current of 0.001 of an ampere would call for a voltage of 1,000 times 0.001 or 1.0 volt. To produce the current assumed to be necessary in the common battery circuit—0.1 ampere—in the same circuit resistance, would require a voltage of 1,000 times 0.1 or 100 volts.

The matter might be presented in another light by assuming that the highest allowable voltage to be used should be 50. With 50 volts it would be possible to produce a current of 0.001 of an ampere in a circuit of 50,000 ohms. With a current of 0.1 of an ampere, such as has been assumed to be the requirements of the common battery circuit, 50 volts would permit of the use of a circuit measuring only 500 ohms.

These results are not be taken as a definite statement of the strength of current flowing over the two classes of telephone circuits, magneto and common battery, or of the resistances over which satisfactory transmission is possible. They are not so widely at variance with actual conditions, however, as to preclude their use as illustrations.

212. *Low capacity.*—In the case of the common battery circuit, as well as the magneto circuit, low capacity is essential. The destructive effect of capacity on telephonic transmission is the same whether the circuit serves common battery or magneto subscribers. We have seen how alternating currents may be said to pass through the condenser while direct currents are barred by it. It will be remembered that the ability of alternating currents to alternately charge and discharge the insulated plates of the condenser made this possible. Now the telephonic voice-carrying currents are alternating in character and of very high frequency. We know, therefore, that they will not be barred by the condenser.

It is true that condensers of differing capacities have differing effects on telephonic voice currents. Speaking from a practical standpoint, it may be said that condensers having a capacity of 2 microfarads offer very little opposition to the passage of the telephonic voice currents.

As the opposing effect due to self induction is called the reactance of self induction, so the opposing effect due to capacity is termed the reactance of capacity. The reactance due to capacity is much greater in the case of condensers having a capacity of only 0.3 of a microfarad than it is in the case of condensers having a capacity of 2 microfarads.

We have seen in section 124 (TELEPHONY, June 15), how the capacity of the telephone circuit absorbs a portion of the energy destined for the receiver at the distant station. It is true that the capacity of a condenser or telephone circuit is dependent upon several factors, one of which is the distance of separation of the two plates or conductors. Other things being equal, the capacity in any given case is increased if the plates or conductors are placed closer together, and it is decreased when they are more widely separated.

213. *Conditions affecting capacity.*—In view of this fact, it would be entirely logical to anticipate a greater capacity in one mile of cable than in one mile of open wire. Other things being equal we should also expect to find the capacity of a loosely wrapped telephone cable lower than the capacity of one more closely made up. In a general way, both of these expectations are borne out by the facts. Telephone cable capacity, however, is worthy of an extended and careful study and will be treated in a later section.

If it were possible for telephone lines to be built commercially with the two sides of the circuits much more widely separated than is the present standard, it would be possible to obtain lower line or circuit capacities. When the distance between the two wires of the circuits is increased, however, the *inductance* or *self induction* of the circuit is increased.

The telephone circuit of Fig. 88-*A*, may be considered as a loop of wire through which an alternating current is to flow. It is clear that while the current is passing out over one wire, it is returning in equal strength over the other one. In other words, the two sides of the circuit constitute a loop of wire of a non-inductive character. This is because the magnetic whirl around one wire is almost exactly neutralized by the magnetic whirl around the other wire *in the opposite direction.* Let us now suppose that the wires are gradually separated until they have reached the form of a circle in the circumference of which are found the central office and the subscriber's station. This condition is shown in the Fig. 88-*B*.

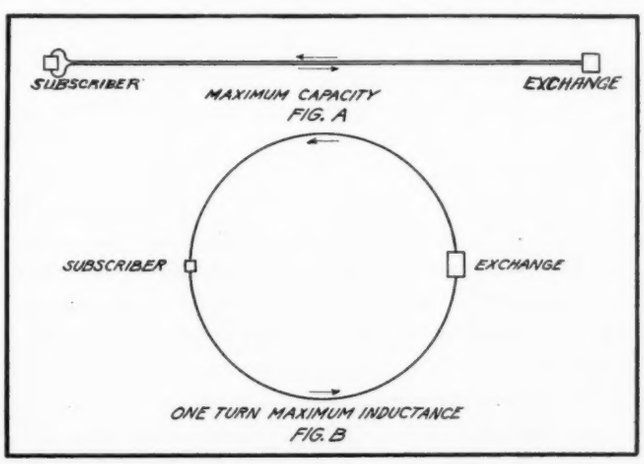


Fig. 88. Conditions of Maximum Capacity and Inductance.

It is clear that the loop of wire comprising the telephone

line has now ceased to be non-inductive and has become highly inductive. In fact, we now have an electromagnetic coil of *one* turn and large diameter in which the exciting current is an alternating current of very high frequency. Under this condition the reactance due to self induction is at its maximum while the reactance due to capacity is at its minimum. It is to be understood that no telephone lines are constructed in this way, but that the concept of a circular loop is used to arrive at a clear understanding of the *nature* of the *self induction* or *inductance* of the telephone circuit. It has been shown how the effect of inductance reactance is opposed to the effect of capacity reactance.

214. *Nature of capacity and inductance.*—The reader must make a clear distinction between the nature of capacity and inductance or self induction and the reactances due to both. Both capacity and inductance or self induction are properties of circuits. Capacity reactance and inductance reactance are properties of circuits *in which energy is being expended.* In other words, all circuits have capacity and self induction, whether they are at the moment carrying currents or not. Their reactance is produced by the expenditure of energy in them to produce or maintain a flow of current.

215. *Capacity as related to transmission.*—Since the capacity of telephone circuits is inherent in the only practicable form in which they are found, and this is determined by the standard methods of commercial construction, it is not susceptible of reduction beyond a certain point. The remedy for the harmful effects of excessive capacity in the transmission is found therefore, in methods of construction. They should produce the lowest possible values for capacity compatible with reasonable mechanical arrangements and with permissible expense.

In such cases as require additional means to render possible the production of satisfactory transmission, the adoption of means to reduce the harmful effect of the line capacity is imperative. In the early '90s, Oliver Heaviside proposed the use of an augmented or increased inductance on telephone lines to counteract the evil effects of capacity. The so-called loading coils consist of an application of this idea worked out in accordance with a remarkably successful method of design and spacing originated by Professor Michael Idvorsky Pupin.

In order to work out the loading for any given circuit conditions of distributed capacity it is, of course, necessary to have available complete and accurate data as to the inductance and capacity and its distribution over the circuit. With this information at hand, remarkable results have been attained in reducing the attenuation and distortion of the alternating current wave forms impressed on the line. When the attenuation and distortion have been reduced, the wave form at the receiving end is more nearly the same as the wave form that would be produced in a circuit having *resistance only* and the transmission is improved accordingly.

(To be Continued.)

American Association of Engineers Plan for Convention.

Plans for the national convention of the American Association of Engineers to be held in Chicago, December 10 and 11, are being rapidly completed. All engineering societies have been invited to send official representatives to the convention to join in the discussions and assist in attempt to solve a few of the welfare problems confronting the engineer.

A national membership committee has been selected to push the organization of local chapters in various parts of the United States. Those appointed on the committee are: A. H. Krom, assistant engineer, Illinois Public Utilities Commission; F. H. Newell, professor of civil engineering, University of Illinois; S. Steenerson, engineer, Minnesota Highway Commission, Crookston, Minn.; Edwin R. Webster, civil engineer, Marion, Ia.; Daniel B. Luten, bridge engineer, Indianapolis, Ind.; O. L. Dent, referee in drainage matters, Bemidji, Minn.; R. A. West, civil engineer, Tye River, Va.; Israel L. Beerman, engineer, New York State Highway Commission, Filmore, N. Y.; Harold Almert, consulting engineer, Chicago; W. N. Winter, electrical engineer, Hood River, Ore.; H. L. Holderman, civil engineer, Chicago, Milwaukee & St. Paul Railway, Lewistown, Mont.; Ernest McCullough, consulting engineer, Chicago; George C. Keech, electrical engineer, Chicago; and A. T. North, contracting engineer, Chicago.

Balance Sheet of Rochester Telephone Co.

According to the balance sheet of the Rochester Telephone Co., of Rochester, N. Y., the total assets of the company on September 1, 1915, were $2,508,920. The detailed statement of assets and liabilities follows:

ASSETS.

Fixed capital	$1,753,222
Added since 1911	408,245
Construction in progress	43,000
Securities of other companies	61,780
Bond coupons	17,037
Cash	34,241
Bills and accounts received	144,183
Materials and supplies	36,662
Prepayments	10,550
Total	$2,508,920

LIABILITIES.

Stock outstanding	$ 489,400
Funded debt	1,147,970
Bills and accounts payable	79,712
Taxes and interest accrued	29,075
Advance service	38,046
Reserves for depreciation	356,038
Surplus invested in plant	368,679
Total	$2,508,920

Illinois Central to Construct New Telephone System.

Plans are being made by the Illinois Central Railroad to construct a new telephone system from Grand Central Station to the south yard shops and to Nonconnah yards to give direct connection with every department in Memphis.

At present Nonconnah is served by five party lines, and the heavy traffic over the lines makes it difficult at times to reach various officials quickly. As soon as the new system is installed the five present lines will be converted into telegraph lines to operate between Grand Central Station and Nonconnah.

It is planned to install a cable from Central Station to Nonconnah. The cable will contain 75 lines for the south side shops, and 40 for Nonconnah. Each yard office at Nonconnah and each mechanical department officer will have an individual line.

Tax Assessment of Idaho Telephone Properties.

The state board of equalization has fixed the assessment of the telephone properties in Idaho at $1,700,000. Ada county was given the largest assessed valuation for telephone lines of any county in the state, the assessment being fixed at $263,550.

The Central Union Matter

Sidelights on Tolls — Cost of Messages — Other Features

By J. C. Kelsey

When a man sets out on a long journey, he has a definite end, for the world is round. He can travel unceasingly in the same direction and will eventually find himself at the starting point. At all times in this earthly journey he can locate himself and make calculations as to the possibilities of making or losing time.

When a man sets on a legal journey, he also has a definite end, as far as the national supreme court is concerned. He can travel unceasingly in the same direction, but he has no definite plan at all.

His case may be appealed or it may be thrown out of court for one of the simplest reasons. His case may be decided by one court in his favor, while a higher court will be of a different opinion and will undo work of years.

Just as the world changes, so do courts.

Courts reflect justice as viewed by the times. We realize now that suits are successfully prosecuted which twenty years ago an outraged judge would have thrown out of court. A supreme court justice once said that a colored man had no rights any white man was bound to respect.

There have been courts which have decided that no minority stockholder has any right which the majority stockholders were bound to respect. A few decades ago it is doubtful that any suit brought by the minority stockholders of Central Union, or any other organization, would have had half a hearing. Today, every word of the minority interests is given full attention.

Surely no one can say that the world is not improving so far as justice between individuals is concerned.

To many intents and purposes, the Central Union suit is a family quarrel. We have often heard of the experience of the man going into a house to defend the shrieking wife who was being beaten by her husband and how both turned upon the meddler.

We have heard such an expression as "when thieves disagree, honest men have a chance." Not that such an expression applies to this case at all, yet we can say that when stockholders disagree, the world has a chance to hear their troubles.

In other words, this quarrel between stockholders gives the telephone world a chance to read the inner thoughts, secrets and workings of a large telephone company which has had a part in the lives of so many Independent telephone men.

The various points of this case are not being aired just for purpose of mischief. Showing dirty linen is not ordinarily a pleasant thing, but there is no personality involved in this great suit.

There is no dirty linen at all, yet there are features which every thinking telephone man should know. So many of us have been so terribly impressed with the power of the Bell interests that it is a good plan to learn the exact force of that power as applied to three great states in which nearly all of America has lived at one time or other.

We have heard so much discussion of the power of money that we have been led to believe that money can do anything. You saw last week where money was sent to the company in great quantities merely for the asking. Yet with that unlimited supply of money, it is revealed that it availed nothing, for the test of finance is always, has always been and will always be from the standpoint of profit.

No enterprise which continually shows loss has any more reason to try to fight than a group of soldiers who find their position untenable. And this enterprise, known as the Central Union, would have surrendered long, long ago had it not been for another group of stockholders whose pride would not let it.

In other words, the American company would not allow the enterprise, so woefully bombarded, to surrender.

This same spirit is shown in the purchase of the Quincy, Ill., plant. The officials of the Central Union Telephone Co., did not care to pay the price set out, but agreed after it was impressed upon them that such a purchase was a good thing for the business as a whole, even if it did cost the underlying company more than it should.

As far as the American company is concerned, that is good business possibly, but as a rule, it makes dangerous conditions for minority stockholders.

So it came to pass that a group of men known as minority stockholders have gone into court to find out how they stand.

The great telephone battle of the week is on a topic which is of interest to the entire telephone world. It is the cost of originating and handling telephone messages.

The American forces have brought forward evidence which goes to show that it costs the Central Union Telephone Co. 12.82 cents to handle a long distance message. In other words, the 1,008,648 so-called A. T. & T. Co. messages cost the Central Union company $129,312 or $.1282 each.

In return, the American company pays the Central Union a little over 13 cents for each message, or a profit shown as follows:

Income per message	$.1308
Cost per message	.1282
Income per message	$.0026

or in other words, practically one-quarter of a cent per message.

How many Independent telephone men have ever really tried to figure out just what their long distance connections bring them? So many telephone men look upon the long distance matter as one of profit alone. Is there any profit or even justice in handling business at cost?

The Pere Marquette railway is said to pay $1,000 per day for the use of the Chicago depot and terminal facilities. The long distance telephone company pays ¼ of a cent to a local company for all its trackage and facilities.

The Central Union company handled practically 3,000 messages a day for the parent company and the foregoing figures would go to show that the Central Union company earns $7.50 a day for the privilege of connection with the A. T. & T. Co. It surely appears to the Independent telephone man that there must be something wrong somewhere.

But wait one moment. The parent company figures on what it would cost the Central Union company anyway. Suppose the A. T. & T. Co. should move out, bag and baggage, what would the Central Union save by such a deal? Bell testimony shows that there would be a saving as follows:

Ohio	$26,042
Indiana	2,967
Illinois	4,963
Total saving	$33,972,

or 3⅓ cents per message.

Accordingly, if this condition is taken into account, the Central Union company earns instead of a quarter of a cent on a call to New York, San Francisco or anywhere else, the sum of 3⅓ cents.

If someone could apply the theory that money saved is

twice earned, he might finally give some dignity to the handling of long line messages—if 6⅔ cents a share could be called worth while, especially after the money had been collected.

In behalf of the minority stockholders, there is an expert by the name of William A. Russell who brings into the telephone world a new standpoint of reasoning. This expert, trained in Europe and the city of New York and outlying territory, after much study, tells another story.

He brings forward figures which tend to show that the Central Union company cannot begin to originate a long distance message for the cost of $.128 which it figures. He shows that it costs the Central Union Telephone Co. $308,000 to handle these million messages or 30½ cents per message. In other words, the local Bell company loses 17½ cents on every message.

It would be interesting to some, at least, to analyze both the Bell expert figures and the Russell figures, but it is not the purpose of this story to go into elaborate detail.

The testimony gives the first ray of light the free field has ever had on a most vital and much debated question. Every connecting company feels that it gets the worst of the deal on long distance service. Whatever justice there is in such contention is a local issue and must be decided on the facts as they exist.

This item alone will keep commissions busy at every telephone switchboard if they go into the costs which actually exist. One thing sure, it will not hurt to know if one has an equitable contract.

Another item of interest follows. This Central Union bell company in Ohio, Indiana and Illinois handled over its own wires and switchboards, 4,241,000 messages. For this service, the income was $918,822 or about 22 cents per message.

In addition to this, the Central Union received 506,086 messages from its connecting companies, or less than one for each Independent subscriber.

On top of this, the long distance wires of Central Union handles 1,868,937 messages between sub-licensees. For this service, the Central Union received $573,512 or 23 cents per message.

This gives us a table as follows:

Received from its own local toll	22 cents
Received from its licensees	23 cents
Received from A. T. & T. Co	13 cents

From the first, the income is based upon exclusive Central Union investment. The second is based upon a combination of Independent and Bell investments. The third is based on the exclusive investment of the parent company.

It would seem that the third investment would be the best if the column showed net earnings. Unfortunately, the net earnings of the third have been shown to be a quarter of a cent. The profit or loss on the other two items are no better known than your own figures of costs.

The following table verifies these figures and may tend to clear up any misunderstanding.

	Originating and Terminating Messages	Earnings
Central Union	4,241,008	$ 918,822
Central Union and sub-licensees	506,086	573,512
Sub-licensees	1,969,937	
A. T. & T. Co. originates	1,007,007	162,000
Total	7,623,038	$1,654,334
Other revenue		51,023
Total tolls		$1,705,357
Gross earnings per message		$ .22
Gross earnings per average 1912 Central Union subscriber		6.96

Leaving the question of tolls with the A. T. & T. Co. estimate of $.1282 per message, and the opposing estimate of $.305 let us turn to the financial performance of the company whose management asked its stockholders in 1904 to wait with patience until the dying Independents turned their faces to the wall.

	Central Union		Associated Bell Companies
Exchange revenue	$20.006		$30.93
Long distance	6.964		9.21
Total		$26.97	$40.14
Operation	$ 9.90		$13.35
Maintenance	6.68		
Depreciation	3.59		13.66
Taxes	1.49		2.02
Total		$21.66	$29.03
Net per station		$ 5.31	$11.11

Compared to all the companies, Central Union has less than half the net earning power of the average. Central Union with capital liabilities of $36,297,509 earns 3.6 per cent. But this licensee company has to pay something for that which every Independent telephone company gets for nothing.

According to the contract between the parent company and the licensee, 4½ per cent. of its gross earnings must be paid to the parent company. This amounts to $306,840 per year or about $1.33 per active station. By reason of this contract, the Central Union Telephone Co. had a little less than $1,000,000 to pay a return on $36,297,509 or about 2¾ per cent. on its obligations.

Surely this Bell company cannot be called a success in any sense of the word. It has made a magnificent fight against natural odds. If the officials had put up their own money to carry out their policies, they could easily claim medals for heroism or get easy admission to an insane asylum.

In passing, do not fail to notice in the preceding table that the depreciation reserve of this company averages $3.59. It calls to mind the great amount of derision hurled at my early conception of $4 per station being close to the actual amount needed for the unexpended reserve.

It reminds us that corporations, as well as individuals, must save or set aside cash for the rainy day. It is only in good weather our corporations or individuals get cash; on rainy days your own is about all you can get.

He that hath shall be loaned unto, and he that hath not shall not borrow on any terms.

As a sidelight, it is seen that subscribers in monopoly centers pay for losses in competitive localities, if the management persists in trying to oppose natural causes.

It is plain that few people realize the extent of the Bell defeat in Illinois, Indiana, Ohio, Iowa, Missouri and Kansas, particularly. It surely should tell financial minds that the mere force of money is a follower and not a leader in affairs of life. Above all, it probably goes to show that few people know when they are whipped.

Aside from comments that have been made, this fact remains pertinent to Independent connecting companies. Are you making a profit of a quarter of a cent upon the messages which you originate, handle and are responsible for in the courts of our land? Are messages costing you 13 cents or 30-½ cents? Are they costing you less? Do you really know?

If the Central Union Telephone Co., in handling A. T. & T. Co. messages, has such a close margin as shown by its American Telephone figures, the chances are that every Independent connecting company, in originating and handling messages to and from the Central Union company, has an equally

close one. And this applies with equal force to every Independent connecting company in America.

The Pere Marquette pays $1,000 a day for the use of a depot and yards. How much is your depot and its yards worth?

MORAL: Figure it out yourself.

Convention of Jovians in Chicago.

The thirteenth annual convention of the Jovian Order opened at the Hotel Sherman, Chicago, Wednesday, October 13, with over 2,000 registered. A fitting reception to the visiting delegates was tendered by business interests of Chicago in the form of a complimentary luncheon on Wednesday noon under the auspices of the Chicago Association of Commerce at the Hotel La Salle. A stirring address was delivered by Dr. Frank W. Gunsaulus, president of Armour Institute of Technology, in which tribute was paid to the contributions of the electrical industry in benefiting mankind.

The opening business session was held on Wednesday afternoon, Reigning Jupiter Homer E. Niesz extending a cordial welcome to the thirteenth convention. City Prosecutor Miller, of Chicago, represented Mayor William Hale Thompson in extending the hospitalities of the city and an eloquent response was made on behalf of the Jovian Order by Henry W. Kiel, mayor of St. Louis.

Henry Harris, of Pittsburgh, then took the chair and presided at the remaining sessions. The report of Mercury Ell C. Bennett presented at the opening session reviewed in detail the work which has been accomplished during the past year and embodied suggestions for future activities. Regarding membership it was pointed out that while the aim of the administration has not been to break previous records in candidates initiated, there has nevertheless been a net gain during the thirteenth administration of 1,231, making the total membership to date of 16,147.

The work of the commercial division of the order was reviewed and the possibilities in this direction emphasized. The "Efficiency Campaign" inaugurated shortly after the annual convention last year has been productive of good results and the articles dealing with various efficiency ideas submitted in a contest conducted by the order contain a wealth of suggestions for improving efficiency in many directions. These articles will be printed in pamphlet form for general distribution.

At the Thursday morning session an address on "Extending the Utilization of Electrical Energy" was made by E. W. Lloyd, president of the National Electric Light Association. "The progress of the Electrical Industry" was discussed in a paper by Fred N. Feiker, editor of the Electrical World, after which Henry L. Doherty, president of the Society for Electrical Development, spoke on "Electrical Prosperity Week."

The Friday morning commercial division session opened with a talk by John F. Gilchrist, president of the Electric Vehicle Association of America, on "Contingent Benefits from Electric Vehicle Sales." Ernest McClary, past president of the National Electrical Contractors' Association, followed with an address on "Safety in Electrical Installations."

At the afternoon session a paper was presented by H. M. Byllesby, president, H. M. Byllesby & Co., Chicago, on "The Public Utility as a Factor in the Development of a City." A paper was also presented by W. R. Herstein, president of the Electrical Supply Co., Memphis, Tenn., on the "Relations of the Jobber to the Electrical Industry."

Thomas A. Wynne, of Indianapolis, was elected Jupiter; E. C. Bennett, of St. Louis, Mercury, and the following district directors were chosen: Dan G. Fisher, Dallas, Texas; James H. Bettes, New York; Henry Harris, Pittsburg; M. H. Moffett, Cleveland; J. F. Ramier, Memphis; C. S. Barnes, New Orleans; Frank D. Beardslee, St. Louis; W. R. Patton, Milwaukee; H. J. Gille, Seattle; John J. Cooper, Denver, Colo., and J. Harry Pieper, Los Angeles, Cal.

The next convention will be held at Indianapolis next October.

The climax of the entertainment features of the meeting was the production of the spectacular, carnival, dance and banquet, the Feast of Jupiter, on Friday evening. The pageant occupied the entire mezzanine and first floors of Hotel Sherman and is said to have been one of the most gorgeous private entertainments ever produced.

Proceedings Before Commissions, Courts and Councils

Discussions and Rulings of State Bodies Having Supervision of Telephone Companies, Decisions of Courts in Matters Affecting Public Relations of Utilities and Actions of City Councils Bearing Upon Franchises, Rates and Service

Rate Increase Authorized at Creswell, Ore.

The Oregon Public Service Commission, on October 4, issued an order authorizing the Creswell Telephone Co., of Creswell, Ore., to put into effect a new and higher schedule of rates. On petition of the company for an increase in rates, the commission made a thorough investigation of the company's conditions and held a public hearing relative to the matter, which disclosed that the rates charged were inadequate. The present rates, now on file with the commission are: Individual line service, $2 per month; party line service, $1.50 per month; farmers' switching rate, $3 per month. The new rates authorized by the commission are as follows:

One-party business	$2.50 per month
Two-party business	2.00 per month
One-party residence	2.00 per month
Two-party residence	1.75 per month
Four-party residence	1.50 per month
Farmer line subscribers, switching service	4.50 per year

Conditioned on the rendering of 24-hour service in place of the present service from 6 a. m. to 9 p. m. on week days and from 8 a. m. to 4 p. m. on Sundays, this new rate schedule becomes effective November 4.

Meeting of Joint Valuation Committee.

The Joint Independent Committee on Valuation met at the Hotel LaSalle, Chicago, October 18. There were present: Chairman S. G. McMeen, G. W. Robinson, A. F. Adams and Wm. Fortune of the committee and C. Y. McVey, E. B. Fisher, W. S. Vivian and F. B. MacKinnon, who are the exceutive officers of the two national associations.

The committee discussed the recent conferences held at Washington in connection with the Interstate Commerce Commission's valuation work. It formulated plans for securing a closer co-operation of all Independent companies, especially in connection with the committee's work. Answers were prepared to the questions asked the committee by Director Prouty. The committee will make a full report of its work at the convention to be held December 8, 9 and 10, in Chicago.

Agreement to Exchange Free Telephone For Franchise.

The New Jersey Public Utility Commission recently disapproved of the proposed agreement between the town of Absecon and the Delaware & Atlantic Telephone Co., by which the town was to get free telephones in exchange for a franchise. In a recent decision the supreme court held that the city of Plainfield could not enforce its contract against the public service corporation for free service, and the commission's action is based upon this decision.

Telephone Company Liable for Guy Wire Injury.

A verdict for the plaintiff in the sum of $1,500 was recently given in the superior court of North Adams, Mass., by a jury in the civil case of W. J. Hifco vs. New England Telephone & Telegraph Co. The plaintiff sued for injuries to his knee received when an automobile in which he was riding on January 13 of last year struck a guy wire in Adams.

Summary of State Commission Hearings and Rulings.

CALIFORNIA.

October: An application for a reconsideration of the decision of the California Railroad Commission of August 12, revising the system of advanced deposits required by telephone companies, has been filed with the commission by the Pacific Telephone & Telegraph Co. The decision abolished to a large degree the existing system of deposits and entailed the refunding of over $1,000,000 held by various telephone and other utilities throughout the state as deposits from patrons. The Pacific company wants a rehearing in order that it may present evidence to cause the commission to modify the order.

October 8: Application filed by the Kerman Telephone Co., of Kerman, Cal., for permission to issue one share of its capital stock at $35.

October 6: Application for authority to issue $21,900 worth of notes to pay interest installments filed by the Union Home Telephone & Telegraph Co., of Los Angeles, Cal. The corporation desires to apply these installments on its six-year debenture bonds amounting to $182,500 for the period November 1, 1915, to November 1, 1917.

October 25: Hearing on investigation into the rates of the Pacific Telephone & Telegraph Co. covering the entire state. A complaint was recently filed with the commission by the city and county of San Francisco. Subsequently the company asked the commission to conduct an investigation and fix rates for its entire system within the state, alleging that it would not be fair to consider rates for one exchange separate from its system.

INDIANA.

October: The Avilla Mutual Telephone Co., Avilla, Ind., has filed a petition with the public service commission asking for the establishment of rates of $1 a month for residence telephones and $1.50 a month for business telephones.

KANSAS.

October 14: Articles of agreement between the Baxter Telephone Co., of Baxter Springs, Kan., and the Cherokee County Mutual Telephone Co., filed by E. H. Hogueland, attorney for the Baxter company, with the commission for its approval. He also asks that the commission dismiss the complaint filed last spring against the mutual company, as the terms of the agreement remove the ground for complaint. According to the terms of the agreement, which were published in a previous issue of TELEPHONY, the mutual company will not operate telephones in the city of Baxter, but will connect with the local company's exchange. Members of the mutual company will have free service into Baxter; patrons of the Baxter company can have connection with the members of the mutual for 25 cents a month, or by paying 10 cents a message.

November 10: Hearing at Emporia, Kan., on the case of the Reading Mutual Telephone Co. vs. the Emporia Telephone Co. and W. W. Finney, president, in regard to service. Docket No. 945.

November 10: Hearing at Emporia, Kan., on the case of the Emporia Telephone Co. vs. the Reading Mutual Telephone Co. Docket No. 985.

November 10: Hearing at Emporia, Kan., on application of the Emporia Telephone Co. for permission to increase rates on desk sets. Docket No. 1116.

MARYLAND.

October 13: Continued hearing on investigation of the Chesapeake & Potomac Telephone Co. in the state of Maryland.

MISSOURI.

October 10: Hearing on a motion filed by the Southwestern Telegraph & Telephone Co. for a rehearing of its application to increase certain rates in St. Louis.

October 20: Application filed by Mrs. Maudelle Reinheimer to sell the property of the Butler-Rich Hill Telephone Co. to Henry W. Neuschafer for $40,000. The property consists of exchanges at Butler, Rich Hill and Spruce, Mo., and farmer lines in that vicinity.

NEW JERSEY.

October 9: The commission disapproved of the proposed agreement between the town of Absecon and the Delaware & Atlantic Telephone Co., by which the town was to get free telephones in exchange for a franchise.

NEW YORK.

October 11: Supplementary petition filed by the Federal Telephone & Telegraph Co. for an extension of an order permitting the company to issue bonds from time to time for the purpose of refunding outstanding obligations represented by underlying bonds.

October 20: Hearing on complaint of the city of Cohoes by its mayor and board of trade and the Business Men's Association of Cohoes, village of Waterford and city of Watervliet against New York Telephone Co. and American Telephone & Telegraph Co., as to rates.

October 22: Hearing on complaint of Frank M. Bradley, of Barker, N. Y., individually and as representing the West Somerset Cold Storage Co. against the New York Telephone Co., as to rates.

OREGON.

October 4: Commission ruled on the petition of the Pacific Telephone & Telegraph Co. for a rehearing of the case of the Wright-Dickinson Hotel Co., et al., vs. the Pacific Telephone & Telegraph Co. and the Home Telephone & Telegraph Co., of Portland and also the case of L. Q. Swetland, et al., vs. the Pacific Telephone & Telegraph Co., the two cases having been consolidated for hearing and disposed of in a single order. The commission reiterates its previous stand that the Pacific company must provide for interconnection at hotels with Independent system.

October 4: Investigation ordered, on the commission's own motion, of the rates, tolls and charges of the Home Telephone & Telegraph Co. of Portland within the state of Oregon and also the company's rules, regulations and practices with reference to the furnishing of such service. The company is required to furnish the commission, within 60 days of the date of this order, information and statements relative to capitalization, intercorporate relations, value of property, earnings and expenses during the 12 months ending June 30, 1915, and general balance sheets of the company's business as of June 30 of each year since the incorporation of the utility.

October 4: Creswell Telephone Co., of Creswell, Ore., authorized to increase rates.

WISCONSIN.

October 15: Hearing at Norwalk, Wis., in regard to the case of the Ontario & Wilton Telephone Co. vs. the Norwalk Farmers Telephone Co. U—828.

October 19: Hearing in regard to the application of the River View Telephone Co. for rate increase. U—831.

October 20: Hearing in re investigation, on motion of the commission, of the alleged denial of telephone service to Wm. Collins, of the town of Fitchburg, Dane county, Wis. U—834.

October 21: Hearing in re application of the Eastern Wisconsin Telephone Co. for authority to increase rates. U—806.

October 22 and 23: Hearing at Madison, Wis., relative to standards and rules for the regulation of high tension wires. The last legislature gave the commission power over high tension lines and now a general standard of service applicable to all is desired by the commission.

October 25: Hearing at Eleva, Wis., on the case of Albert E. Faast vs. the Shaw Telephone Co., in regard to service. U—830.

October 26: Hearing at Cadott, Wis., on the case of August Cirkel, et al., vs. the Cadott Telephone Exchange, in regard to service. U—832.

October 27: Hearing at Mineral Point, Wis., in the case of the Farmers Independent Telephone Exchange vs. the Mineral Point Telephone Co. in regard to physical connection. U—836.

October 28: Hearing at Mineral Point, Wis., in the case of the Mineral Point Telephone Co. vs. the Dukes Prairie Telephone Co., the Mineral Point & Jonesdale Telephone Co. and the Iowa & LaFayette Telephone Co., in regard to violation of law. U—840.

October 27: Hearing at Mineral Point, Wis., in the case of Harry Collicut, et al., vs. the Dukes Prairie Telephone Co., the Mineral Point Telephone Co. and the Iowa & La Fayette Telephone Co., in regard to violation of law. U—841.

Queries on Theory and Practice

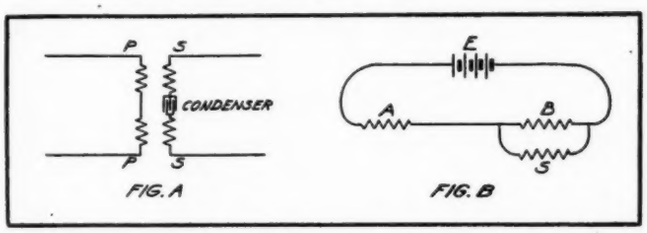
Condenser in Phantom Circuits—Resistance Calculation.

In the Bell system of simplexing and phantoming, I notice that they use a condenser in the secondary between the two windings as shown in the accompanying sketch (Fig. *A*). Will you explain what the advantage, if any, is of this? Also will you please state how to calculate the resistance of a shunt which is to be used for reducing the current supply to a non-inductive load?

The use of the condenser is to prevent direct current from flowing from one side of the physical circuit to the other, whenever the apparatus requires the application of battery across the line. This is true of some lines used for railway train dispatching.

We suppose that you refer to a condition such as indicated in Fig. *B*. Of the two resistances, *A* is a line which is in series with a load, *B*.

It is desired to add a shunt *S*, such as will reduce the current in *B* to any desired amount. Let i = the desired current in the load, *B*, and E = the voltage of the battery. Then the resistance of the shunt will be:



Condenser Connection—Resistance of Shunt Calculation.

$$S = \frac{i\,A\,B}{E - i\,(A+B)}$$

Example: Let $E = 100$ volts, $A = 40$ ohms, $B = 60$ ohms, and $i = 0.5$ ampere, the current desired in the load, *B*.

$$S = \frac{0.5 \times 40 \times 60}{100 - (0.5 \times 100)} = \frac{1{,}200}{50} = 24 \text{ ohms (shunt).}$$

Proof: The joint resistance of *B* and $S = \frac{60 \times 24}{60 + 24} = \frac{1{,}440}{84} = 17.14$.

$$\text{Total current} = \frac{100}{40 + 17.14} = 1.75 \text{ amperes.}$$

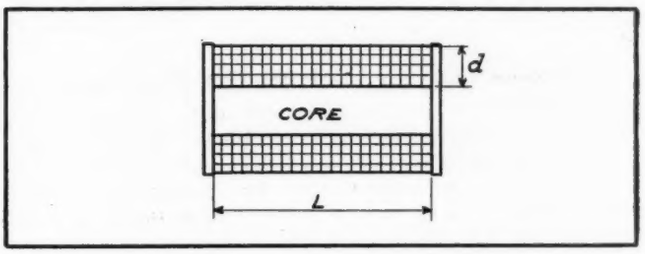
$$\text{Current in } B = 1.75 \frac{S}{B+S} = 1.75 \frac{24}{84} = 0.5 \text{ ampere.}$$

Solenoid Calculations—Inductance of Ringer.

Is there any way of finding the number of turns of wire there is on a solenoid and the number of layers if the ampere and voltage across terminals and the resistance and the diameter of iron core and length of core and the diameter of the face of solenoid and the winding space is known? What do you consider the inductance of a standard common battery set ringer used by the W. E. Co.—resistance 1,000-ohm bell at 16⅔ cycles in series with a two mf. condenser and no cable resistance? What is the least amount of current that will ring the average bell without cable resistance?

In order to calculate the number of turns from the dimensions of the winding space, the overall diameter of the wire must be known. One can usually find this by inspecting an exposed end of the wire. The essential dimensions of the winding space are: Length between heads, diameter of core (if round), and diameter of heads.

If the core and heads are rectangular, their dimensions must be known. Calculate the cross sectional area of the winding space by multiplying the distance between heads (L) by the distance from the core to the outside of the head or as far as the winding extends, d. Both L and d must be in inches. If m is the diameter of the wire over all, the number of turns is:



The Winding Space of a Solenoid.

$N = \frac{L \times d}{m^2}$, that is, the area of the winding space divided by the square of the diameter of the wire.

The results will not be exact, for wire diameter is hard to determine exactly, and varies along the wire. Whether the wire is smoothly or roughly wound also is important.

The inductance of a Western Electric 1,000-ohm bell is approximately 30 henries to ringing current. The inductance is not dependent on other apparatus connected in the same circuit.

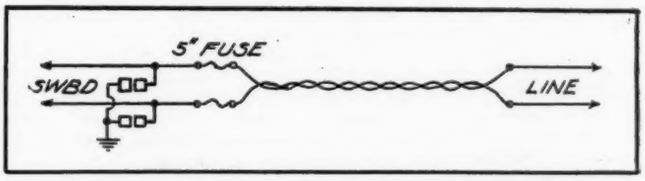
The least current which will reliably ring a straight line bell is about 0.005 ampere (5 milliamperes). This is independent of external conditions.

Connection of Fuses and Lightning Arresters.

It is the usual practice to install a distributing rack with carbons toward the line and fuses toward the switchboard. Why? Also it is recommended that there be a fuse between the exposed line and carbons to open in case of crosses with power wires. For a small office it is proposed to connect the lines to the rack with No. 17 B. & S. copper clad paired distributing wire or No. 18 paired bridle wire. Should they be connected as shown in the accompanying diagram?

The way which you show in your diagram is correct. The fuses must be between the carbon lightning arresters and the exposure to foreign current. This is the way which modern engineers recommend and has been the customary practice on plants for years.

The foreign current, if of sufficient voltage, will jump across the air gap of the arrester to earth. The strong current flow which results will blow the fuse, open the line, isolate the switchboard and put out the arc in the arrester. If the device be turned around, with no fuse between the arrester and the line, the arc once started will be maintained and may cause a serious fire or melt your wires.



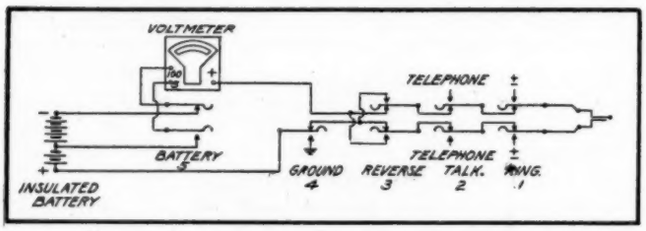
Proper Connection of Fuse and Arrester.

Circuit for Testing.

We have 285 lines, 730 subscribers, mostly on grounded lines. We want to use a voltmeter and battery to test our grounded lines for ground, and the metallic lines for both ground and

short-circuit. Our voltmeter has two scales—one 0-5 and the other 0-100. Will you kindly outline the most approved circuit for such needs?

A good simple circuit is shown in the accompanying sketch. Keys 1 and 2 are for ringing and talking, and have nothing to do with the voltmeter test. They are very convenient, because people often come in on a line during a test, and it is



Suggested Circuit for Testing on Grounded and Metallic Lines.

an advantage to be able quickly to switch from the test to a talking condition so as to find the exact state of affairs or to request them to get off the line.

The normal condition tests the mutual insulation of a metallic circuit; that is, the insulation between the two wires. Throwing the grounding key, 4, tests the insulation of the tip side of line from earth. Throwing both ground key, 4, and reverse key, 3, tests the insulation of the sleeve side of the line from earth.

Earth return lines are tested for resistance by operating key 4 or keys 3 and 4, depending upon which jack terminal, tip or sleeve, is used for the line.

The low voltage battery and connection of voltmeter are obtained by throwing key 5. Its springs must be adjusted to break widely so as not to have both connected at once.

Anchoring Rural Lines Against Sleet.

Will you please tell me the best and cheapest way to anchor rural lines against sleet?

That is a matter involving careful study of local conditions. Your past experiences should indicate to you what points on your lines are most subject to heavy sleet. If proper records have been kept, they should reveal the most common failure points. Those who have been connected with the plant for a number of years can frequently remember the facts. Narrow river valleys are particularly bad.

The corners should be carefully guyed, with ample deep set anchors and large guy strand. These vary with the number of wires in the lead so that we cannot give exact figures. Set the anchors as far from the foot of the poles as possible. Use several disks made of concrete (18 ins. to 2 ft. diameter by 4 to 8 ins. thick), having a separate guy for each anchor. These are far superior to wooden logs. Watch especially the down-hill slopes, "head-guying" frequently to stiffen the line against the full of the line down-hill, because it tends to snap the poles off.

Above all, don't space the poles too far apart. More trouble comes from this than any other one source, and no amount of guying will prevent trouble. Thirty-five poles to the mile (150 feet span) is safe for most points, although some places will require as many as 40 poles per mile (132-foot span). The span next a corner should be cut to 75 feet.

Practical Subjects—Letters and Discussions

Attaching Guy Wires to Trees.

Supplementing the item published on page 35, TELEPHONY of August 21, with reference to correct method of attaching guy wire to trees, I quote a letter of October 9, from one of our managers, which reads in part as follows:

"Several days ago Mr. S—— of ——— asked us to remove a guy wire, which has almost killed a tree in his yard. Mr. S—— says the guy was put on by Mr. J—— while manager for the company, and he promised to keep block of wood between the wire and tree. Now Mr. S——'s rent is due, and he won't pay until we pay him damages. He first said he valued the tree at $50, but wanted to be fair about the matter and thought we ought to allow him a year's telephone rent."

After an investigation, it was found that this guy wire had been placed on the tree with *two turns* around the tree, instead of only one turn. By this method the tree was "choked" and could not grow, hence the above adjustment was next in order.

J. J. Veatch, District Manager,
Paris, Ky. Central Home Telephone & Telegraph Co.

Some Hints for Reducing Maintenance Cost.

Now that the season of electric storms has passed for another year, says F. W. Hill in a recent issue of The Telephone News, the time has come to make preparation for as low a winter maintenance as possible. As in most cases rural lines have been straightened up and weak spots strengthened in anticipation of winter winds and storms, our attention naturally turns to the individual station.

In rural districts the most expensive form of winter maintenance (outside, of course, of extraordinary storm trouble) is driving out on isolated station trouble. On all magneto exchanges our routine calls for an annual inspection with the primary object of renewing batteries. If this inspection were made more carefully a considerable saving could be effected in the maintenance.

A slight grinding noise in a cord, a bell adjustment poorly made, or a generator turning stiffly, besides countless other little things requiring only a moment or two to repair, may develop into a genuine case of trouble at just such a time when weather and road conditions make it an expensive proposition to reach it. A broken ground wire, while possibly of little consequence at this time of year, may result in the loss of an instrument next summer.

These little things if gone over yearly would result in cheaper maintenance and greatly improved service to the public whom we serve.

Book of Suggestions to Subscribers.

"A Little Book of Suggestions for the Good of the Service," is the title of a booklet recently issued by the traffic department of the Chicago Telephone Co., and enclosed with its bills to subscribers. Instructions are given as to the proper use of the telephone; that is, how to place and answer a call. Some pointers in enunciation are given in order to avoid mistakes due to the similarity in the sound of figures as given over the telephone. For instance, "0" should be spoken as "Oh," with a long "O" and "1" as "Wun," with a strong "N", etc. Special emphasis is laid upon the importance of courtesy in the use of the telephone.

Some explanations are given as to the probable cause of busy signals, and an effort is made to impress upon the subscribers the fact that the company is interested in making the connection as soon as possible. What to do when a wrong number is obtained; how to signal the operator; and failure to get your party are also taken up. Instructions are given in regard to reporting trouble. Subscribers

are requested to state the case clearly and avoid exaggeration, and be reasonable in their complaints, thus co-operating with the company to improve the efficiency of the service. The various classes of telephone calls are explained and some suggestions given in regard to placing calls of each particular class.

In conclusion the company invites each subscriber to visit the exchange nearest his residence and learn how the apparatus works and how connections are established.

Some Hints to Troublemen.

This little start has been so often repeated that it needs comment only in the fact that some new fellows may not know of it. If your ringer movement freezes or sticks, take the armature off and anneal it to a cherry red in the flame of a blow torch or kitchen stove and let cool in the air—not water. This will cure about 90 per cent. of your sticky ringers.

If you use the old No. 400 lightning arrester and find that the mica strips fall out frequently put in a piece of silk ribbon on each side and snap a rubber band around the blue carbon in the middle—not endwise. Lightning will put a hole in the ribbon, but you will not have the trouble cleaning your arresters.

A ground rod can be salvaged in two minutes with a pair of connectors and a piece of two by four, to be used on a lever. It comes up easily.

Some rainy day get a piece of steel umbrella wire about eight inches long and carry it in your tool bag. It is very useful in straightening those bent copper sleeves that we always happen to have on top of a pole when the rain or sleet is blowing.

A burned out induction coil may also be repaired as a last resort by carefully removing the head of the coil and picking up the broken end and replacing it again. If the head will not come off drive a brass pin into the hole and solder a piece of wire onto it.

When repairing your switchboard cords often the plug sleeves are found to be loose, due to the screw hole being worn too large. Don't throw them away. Turn them around and drill another hole on the reverse side.

A cake of soap and a cloth will make those old dirty telephones a thing to quicken your pulse.

A good soldered joint doesn't need a pound of solder, but better a pound than none at all. I once knew a troubleman who was careless and forgetful, but he had enough ingenuity to make up for it. He had occasion to solder a joint and he had no flux. What do you suppose he soldered the joint with? A combination of kitchen soap, baking soda and some other things I can't remember, but he soldered it.

Aberdeen, S. D. R. H. Perry.

An Interesting Experience of a Real Operator.

Some little naivete and a good deal of food for thought is contained in "A Real Story," read at a recent meeting of the operators of the Paducah Home Telephone & Telegraph Co. The author is Miss Bessie Gray and the story is apparently an experience of her own. It follows:

"A traveling man just stopping at this city was at the Palmer House. He had never been here before, and knew little of this city and the people. He had made the remark to a friend that he would soon find out what the inhabitants of this city were by the majority. When he came in contact with the telephone operators he said he could always tell by the tone of their voices. In ten minutes he was calling several of the business men of this city and finally gave four calls to the toll operator.

The first call was to Louisville, and was received at 6:57 p. m., but the line was N. C. Madisonville, and at 7:05 was N. C. Owensboro, until 7:32. At 7:34 it passed to Louisville, 7:40 the operator said U. D. L. W. When this was reported to the party calling he began to be impatient. But the operator told him not to get discouraged and impatient, that she would do her very best and get the party as soon as possible in such a sweet and kind voice that he seemed to forget about his impatience, and said she certainly was the most encouraging operator he had ever talked to.

At 8:01 Louisville was asked to A. O. again and the response was U. X. City, and that was all. She never came in on the line again. In the meantime the man had talked to the other three parties called for. The report was then given to him. He was very sorry at the last report, and said, 'Why didn't Louisville give it the first time?'

He also noticed the different tone of voice that talked to him now; and told her not to be scared because she had to lose the call. He knew she had done her very best, but said that she must practice what she preached, and not get impatient because she had to C. A. the ticket.

About two weeks later this same party was going from Louisville to Cairo. There was something he had neglected, and he wanted to call Louisville before going on to Cairo. He went to the booth at the Union Station, put the call in and said he would wait on the line and be ready. After one N. C. to Louisville the call was passed. It was then 6:14 p. m. He only had six minutes longer. He waited as long as he could. At 6:20 the train left for Cairo. He had gone and left the receiver down. You could hear the whistle blow very plainly. At 6:22 Louisville was W. H. and Paducah was U. X. City.

It was 8:25 p. m. when Cairo asked Paducah to help her to get Louisville, as she had a party waiting at a pay station. At first she had a little trouble, but finally the call was passed to Louisville. She was W. H. in a few minutes, and the parties talked.

The man was the very one that had put in the call from the Union Station two hours before. He did not lose his call, but I lost my ticket, on account of a few seconds' delay on the circuit."

Miss Bessie Gray, of Paducah, Ky., operator at the exchange of the Paducah Home Telephone & Telegraph Co., is one of the ready writers on the circuit of the Central Home company. She not only makes a good story in prose but occasionally tries her hand at verses. These are read at the meetings of the local operators and are much appreciated. Two recent bits of verse by Miss Gray follow:

THE JOLLY LITTLE CENTRAL GIRL.

I'm a jolly little central girl, and work nine hours a day;
My telephone subscribers are my very best friends, they say,
Their calls I answer pleasantly, with connections all correct,
And not at all my work do I neglect.

I work all day, from morn till night,
Not hardly stopping for my lunch,
But then when our working hours are over,
Out for a nice time we all make a big bunch.

I'm a jolly central girl, always making some one glad—
Talking nice to my subscribers all the while,
And every night when I go home, never think of being sad,
I always have a great big whopping smile.

THE BOOSTING OPERATOR.

I am boosting for new subscribers
While boosting is very fine.
With other good operators
I am keeping in line.

I boost for our company all I can
And help get new subscribers by the score.
And then when I can get the time
I just go out and hunt for more.

Our manager is so very jolly—
He is pleasant to see
When he hands out the checks
To operators like me.

Fundamental Principles of the Telephone Business

A Reading Course Designed to Present Logically the Principles Which Underlie Successful Organization and Operation of Telephone Properties—Prepared Under the General Supervision of Stanley R. Edwards—Part I, Telephone Economics, by James H. Shoemaker, Completed June 26, 1915—Part II, The Corporate Telephone Organization, by J. C. Kelsey and S. R. Edwards, Completed September 25 Part III, Telephone Accounting and Auditing, Written by James H. Shoemaker

Quiz Questions on the Preceding Installment.

17. What is one of the purposes of records?

18. What device did one telephone manager adopt?

19. What was his idea?

20. State one advantage which was derived by the manager from the use of the "balance sheet tree."

21. What other specific advantage resulted from the use of the drawings?

22. What entries are made in the Cash-Journal specified by the Interstate Commerce Commission?

CHAPTER II. The Opening Entries (Continued).

23. *Opening Entries for Uniform System of Accounting.*—Illustrations have been given in preceding sections of "Opening Entries" which might be used in ordinary bookkeeping. If a new telephone company were being formed and the shares were being sold for cash at par value, the second example of section 14 could be followed in the making of the opening entry under the uniform accounting system. If, however, the shares were sold above par, then the form of the "Opening Entry" would have to be similar to the following:

Jan. 2, 1915.	Dr.	Cr.
Fourth National Bank	$11,000.00	
To Capital Stock		$10,000.00
To Premium on Capital Stock		1,000.00

Explanation:

100 shares of capital stock originally issued at 10 per cent. above the par value of $100 per share, for cash as follows:

Certificate No. 1 To John Doe, 5 shares	$ 5,500.00	
Certificate No. 2 To D. Crane, 5 shares	5,500.00	
	10	$11,000.00

This example is based upon the assumption that the Interstate commission's plan of a Cash-Journal is to be used. Following the same plan, of a combined cash book and journal, further examples of "Opening Entries" are offered, as follows:

When stock is issued for cash below par:

Jan. 2, 1915.	Dr.	Cr.
Fourth National Bank	$9,000.00	
Discount on Capital Stock	1,000.00	
To Capital Stock		$10,000.00

Explanation:

100 shares of stock originally issued at 10 per cent. below par, sold for $90 per share, as follows:

Certificate No. 1 To John Doe, 5 shares	$4,500.00	
Certificate No. 2 To D. Crane, 5 shares	4,500.00	
	10	$9,000.00

(The reader should observe that in certain states it is against the law to sell stock at less than its par value).

24. *Entries When Stock is issued for Property.*—When stock is issued for property, in cases where the property has been appraised and the par value of stock issued exactly equals the appraised value of the property, the debit is made direct to the plant account, in accordance with the figures appearing in the appraisal.

Jan. 2, 1915.	Dr.	Cr.
Pole lines	$4,000.00	
Aerial cable	3,500.00	
Aerial wire	2,500.00	
To Capital Stock		$10,000.00

Explanation:

100 shares capital stock originally issued at the par value of $100 per share in payment for what is known as the Brownsville Telephone Exchange, located in Brownsville and vicinity, as more fully set forth in a document on file labeled "Appraisal of Brownsville Telephone Exchange Properties."

When stock is issued for property, the appraised value of which exceeds the par value of the stock, the entries are:

Jan. 2, 1915.	Dr.	Cr.
Pole lines	$4,000.00	
Aerial cable	3,500.00	
Aerial wire	2,500.00	
To Capital Stock		$10,000.00

Explanation:

100 shares of capital stock originally issued at the par value of $100 per share in payment for what is known as the Brownsville Telephone Exchange, situated in Brownsville and vicinity, as more fully set forth in a document on file labeled "Appraisal Of The Brownsville Telephone Exchange Properties."

The said appraisal shows property values which are in excess of the par value of the stock issued. Reduction of the appraisal values having been made before charging the same to plant account, as follows:

Pole lines from	$ 4,400.00	to $	4,000.00
Aerial cable from	3,850.00	to	3,500.00
Aerial wire from	2,750.00	to	2,500.00
	$11,000.00		$10,000.00

It must be understood that the Interstate Commerce Commission does not allow the plant account to be debited with the full appraisal value unless stock is issued at par for the full amount or cash, or its equivalent, paid in some form other than a stock issue.

When stock is issued in payment for property which has not been appraised at the time of the opening of the books the entries are:

Jan. 2, 1915.	Dr.	Cr.
To Unappraised Property	$10,000.00	
To Capital Stock		$10,000.00

Explanation:

100 shares of capital stock originally issued for unappraised property known as the Brownsville Telephone Exchange, located in Brownsville and vicinity, appraisal of which is to be made and recorded later. The list of certificates, names of shareholders, etc., follow as given in foregoing illustrations.

In the last-named case, the account set up in the name of "Unappraised Property" must be "closed out," when the appraisal has been completed, in some such manner as the following:

(Cash-Journal)

Adjustment entry, based upon final appraisement of Brownsville Telephone Exchange property:

July 7, 1915.	Dr.	Cr.
Pole lines	$4,000.00	
Aerial cable	3,500.00	
Aerial wire	2,500.00	
To Unappraised Property		$10,000.00

In all of the foregoing examples it must be understood, of course, that the debit, or charge, to the plant account must be in as complete detail as may be required by the Interstate Commerce Commission's instructions in regard thereto. The items mentioned are solely for the purpose of illustrating the principles which are involved in the "Opening Entries." They are not intended as an illustration of the proportions or of the details of the plant account.

25. *The Stock Subscription Ledger for Recording Installments.*—It sometimes happens that a company starts with a list of stock subscriptions which are to be paid up in a given number of installments. If the Brownsville Telephone Co. were starting under circumstances of that kind, a "Subsidiary Stock Subscribers' Ledger" would have to be kept. Perhaps the best way for a beginner to get this requirement most clearly in mind would be as follows:

Consider the collecting of these stock subscriptions as though it were a business wholly separate from the company. Just look upon the accounts with the subscribers to the stock as though they were being kept by the bank, or by some individual, until the cash actually passes into the hands of the Brownsville Telephone Co.

In the stock subscription ledger a separate account must be opened with an original debit, against each subscriber, for the total amount of his subscription. Then, as each pays his cash to the company, his account is credited accordingly. This is done by an entry made in the stock subscription ledger to correspond with the entry made at the same time in the cash book, or "Cash-Journal."

We will, for instance, assume that John Doe has subscribed for ten of the hundred-dollar shares. He is to pay it in five equal installments of $200 each. When the first payment is received, the $200 is first debited (in the "Cash-Journal") to "cash" or "bank" as the case may be; and the corresponding credit in the General Ledger will be made to an account called "Capital Stock Installments." The Cash-Journal entry will appear as follows:

Jan. 2, 1915.	Dr.	Cr.
Cash	$200.00	
To Capital Stock Installments		$200.00

Explanation:
First installment of 20 per cent. received on 10 shares of capital stock subscribed for by John Doe.

When John Doe's subscription has been fully paid in, the portion of the "Capital Stock Installments" account that is represented by his subscription, is closed out, or "balanced up," by an entry in the following form:

Jan. 2, 1915.	Dr.	Cr.
Capital stock installments	$1,000.00	
To Capital Stock		$1,000.00

Explanation:
10 shares of capital stock originally issued at the par value of $100 a share, for cash, as follows:
Credit No. 1 to John Doe, 10 shares, $1,000.00.

When all subscription accounts (in the stock subscription subsidiary ledger) have been similarly completed the entire account of "Capital Stock Installments" will be balanced—*it will close itself out.*

26. *Crediting Installments on Stock.*—It will be observed that in opening each stock subscriber's account in the subsidiary ledger, an arbitrary debit is made against him for the entire amount of his subscription. No account is credited. Therefore, whenever cash is entered in the "Cash-Journal" from this source, whenever money is taken in as payment on a stock subscription, an extra or arbitrary credit must be made. In addition to crediting the amount in the general ledger to the account called "Capital Stock Installments," it must also be credited arbitrarily to the subscription account of John Doe in the "Stock Subscription Subsidiary Ledger."

This is why the beginner is asked to think of this "Subsidary Ledger" as nearly as possible as though it were kept by some other person or company. Its balances are wholly foreign to the "trial balance" which one might take from the general ledger. (*To be continued.*)

A. T. & T. Co. to Enter Telegraph Business.

According to a report recently circulated in Boston, the American Telephone & Telegraph Co. is to become an active competitor of the Western Union and Postal Telegraph companies in the field of telegraphy.

It is said that the telephone company has for some time been preparing to enter the field in opposition to the rival companies. With its tremendous system of wires, which can be utilized for transmitting messages by instrument as by voice, it is pointed out that a paying competitive system could be easily installed.

Following the dissolution of the merger of the Western Union and American Telephone & Telegraph companies, the latter company gave up the telegraph business. This part of the industry was left to the Western Union, which had originally developed the business on the big scale on which the combined companies planned to conduct it.

The new departure planned, it is said, will enter a new competitive feature, especially locally, where the telephone system has so many lines and such facilities for reaching every district in the telephone field.

Brown Telephone Co., of DeWitt, Ark.

In a recent edition of the Gillett (Ark.) reporter, boosting the state fair, which was held at DeWitt, Ark., last week, the Brown Telephone Co. was featured, among other home enterprises. Attention was called to the fact that when subscribers of the Brown system pay their monthly bills they have the satisfaction of knowing that they are patronizing a home industry and the money remains at home.

The Brown Telephone Co. was organized some years ago by H. C. Brown and four years ago it was incorporated by H. D. Rogers. About 500 subscribers are served by this company in the towns of Gillett, Almyra, St. Charles, Stuttgart, Ethel, Crockett's Bluff, and DeWitt.

The principal stockholders of this corporation are Mr. and Mrs. H. D. Rogers. The exchange is located on the second floor of a new brick building, which this company recently built and constructed particularly to answer the needs of the telephone business.

From Factory and Salesroom

Conventions: Independent of America, San Francisco, Oct. 26-29; Local Owners of Texas, Ft. Worth, Oct. 27-28; Canadian, Toronto, Nov. 10-11; Missouri, Kansas City, Nov. 16-17; Ohio, Columbus, Nov. 18-19; National, Chicago, Dec. 8-10; South Dakota, Sioux Falls, Dec. 15-16; Minnesota, Minneapolis, Jan. 25-26

Location of Water Trouble in Cables.

By Chris D. Stewart.

The location of water trouble in cables has always been quite a problem. When induction instruments first came out, it was thought that the problem was solved. However, in practice it was found that the trouble in many cases could not be located at all and in some cases the instruments gave a false location.

By induction instrument is meant the sending of a current out over the wire and back by way of the fault and by picking up the induction set up around the wire with a coil connected to a receiver. This induction causes a tone to be heard in the receiver when the coil is held on the cable between the instrument and the fault. This tone can only be heard up to the point where the trouble is located and not beyond. In this way trouble can be located at the exact spot.

In water trouble, however, the tone could be heard beyond the trouble. The reason for this is as follows:

The tone scatters at the fault and passes to the cable armor. When it reaches the armor, it splits and some of it passes back to the instrument on the armor and part goes forward on the armor to ground and back by way of the ground to the instrument. This puts the tone on the armor ahead of the fault.

Stewart Bros., of Ottawa, Ill., have made extensive tests for the location of water trouble with induction instruments. The exploring coil is so made, it is stated, that it will not pick up the tone on the armor. Therefore hearing of the tone beyond the trouble is eliminated when a Stewart cable tester is used.

Another difficulty encountered in testing for water trouble was that the tone will scatter from the armor to the messenger at some place where it comes in contact, or through a metal hanger. As a messenger is usually grounded at both ends, the tone will split and pass both ways to ground and cause tone ahead on the messenger.

The Stewart exploring coil is so shaped that when held on the bottom of the cable it is neutral to the tone on the messenger. As the coil itself is neutral to the tone on the armor and when held on the bottom of the cable is also neutral to the tone on the messenger, by holding it on the bottom of the cable, Stewart Bros. claim to have eliminated these two causes.

In testing for water trouble it was also found that the tone would go ahead on the capacity of the wires under test. This was overcome by Stewart Bros. sending out a tone of such nature as to not carry on capacity of wires.

It has long been known by engineers that if a coil is held over a conductor with exactly half of its windings on each side of the conductor, no current will be induced in the coil by reason of currents passing over the conductor. In Fig. 1, the large circle represents a large cable and the small circle a small one. In either instance, the center of the exploring coil is exactly over the center of the armor and in a neutral position. This occurs regardless of the size of the cable.

The exploring coil as it is held to the cable is shown in Fig. 2, while Fig. 3 shows the instrument complete. The sender is operated with two dry cells and these are contained in the same case. There is also room in the case for the exploring coil and receiver when not in use.

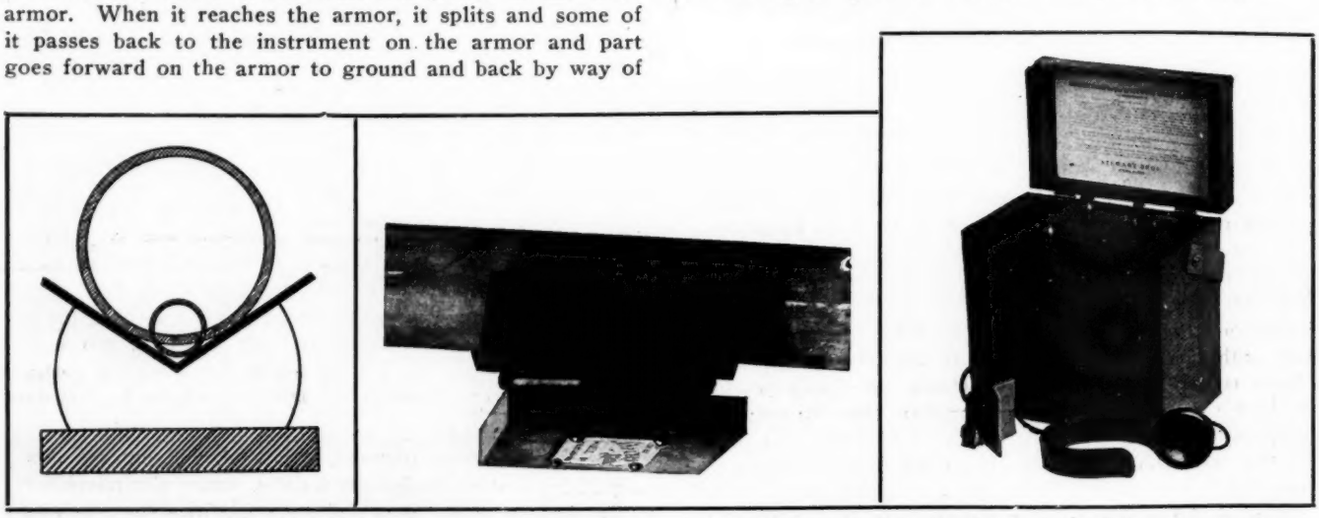


Fig. 1. Exploring Coil Over Center of Armor. Fig. 2. Exploring Coil in Position Under Cable—Fig. 3. The Stewart Test Set.

Fig. 4 shows how the current on the armor and messenger is neutralized and the current on the cable wire itself is off balance with the center of the coil and produces a current in the coil. By taking each field one at a time, its effect can be traced.

Take the field of the messenger wire first: By closely following the circles marked "messenger field," it will be noted that the lines of force travel through the coil as much on one side as the other. The current set up on one side of the coil is neutralized by the current set upon the other side, as one flows in one direction and one in the other. Hence this field produces no effect in the coil.

By tracing the circles marked "armor field," it will be noted that the currents neutralize the same as in the messenger field. However, the armor field is neutral no matter where the exploring coil is held on the armor, while the messenger field is only neutral when the coil is held on the bottom of the cable.

As no wire runs straight through a cable—they are run

in a spiral—the field set up around the conductor is off balance with the coil; that is it lines of force cut the windings of the coil more on one side than the other and set up a current in the coil, the sound from which can be heard in the receiver.

It can be seen that the Stewart exploring coil actually

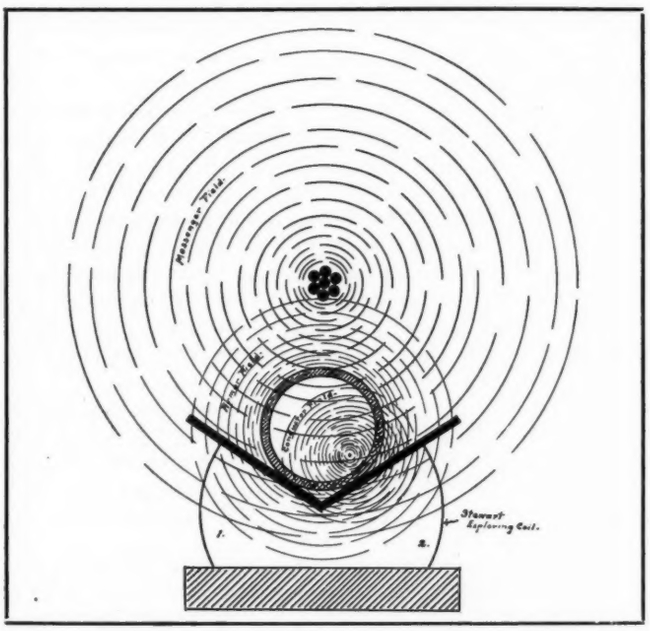


Fig. 4. Neutralizing Effects and Unbalance.

selects the tone on the wire under test and ignores the other fields and in this way eliminates a chance of a false location or no location at all.

Columbus Handle & Tool Co. Increases its Facilities.

Many of TELEPHONY'S readers who have for years used the products of the Columbus Handle & Tool Co., of Columbus, Ind., will be interested in learning of recent additions and extensions in the form of new buildings equipped throughout with the latest improvements and modern machinery. These recent improvements will enable the Columbus Handle & Tool Co. to accommodate the increasing demand for its linemen's and railway construction tools comprising shovels, spoons, pike poles, pole supports, tamping and digging tools, etc.

A wise choice was made in the selection of Columbus, Ind., for the plant's location. Not only is Columbus conveniently located with regard to the hardwood timber belts, but it is centrally located and its accessibility facilitates service on both the raw material and finished product.

The Columbus Handle & Tool Co. believes in specializing or concentrating along definite lines. This has served to give its products a reputation for quality and service which is very properly regarded as one of the firms chief assets.

The company issues frequently very complete illustrated catalogs in which the full "Columbus line" is described and priced. A copy of its latest catalog will be mailed to interested upon request.

Holtzer-Cabot Electric Co. in Its New Factory.

The new factory of the Holtzer-Cabot Electric Co., on Amory street in the Roxbury district of Boston, has just been occupied by the company. The executive offices and factory, formerly at Brookline, Mass., have been moved to the new location, together with the Boston factories of the company, which were located on Albany street and on Bristol street, thus bringing under one roof all the departments of the industry.

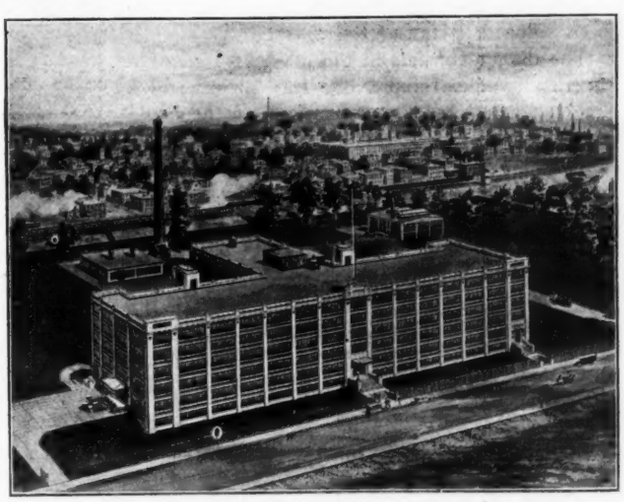
The new factory consists of a main building 300 feet long by 60 feet wide, six stories high, with an annex 100 feet long by 60 feet wide, 6 stories high, and with a sub-basement 60 feet by 60 feet which is used as a garage. The boiler house is 42 feet by 42 feet, 20 feet high, with a 5-foot 6-inch chimney, 102 feet high; the foundry building is 60 feet by 60 feet, one story high.

These buildings are grouped on a lot of land of approximately 250,000 square feet. The construction is reinforced concrete with brick paneled walls on the outside and terra cotta partitions plastered on the inside, and is fireproof in the true and strict sense of the word. Woodwork has been entirely eliminated, with the exception of the few office partitions and finish on the second floor in the general office. All other doors and door trim, hand rails, etc., throughout the manufacturing portion of the building, are metal or metal-covered.

The electric light and power is furnished by the Edison Electric Illuminating Co. and is run directly from its mains into a transformer house which is 16 feet by 25 feet and located in the yard outside of the building. From this transformer house the different mains are carrier to the different parts of the building. Seven large conduits approximately three inches in diameter run directly from this transformer house to the south end of the third floor of the building, which is the test room for all electrical apparatus. These conduits carry the heavy mains to a large switchboard 30 feet long, specially designed and built by the Holtzer-Cabot Electric Co., which supplies the different testing benches, so that any conceivable kind of electric apparatus can be tested. A complicated and complete system of direct current wiring is installed which takes care of the telephone and factory signal system. This system connects all portions of the factory with the switchboard in the main office.

The business of the Holtzer-Cabot Electric Co., was established in 1875 by Charles W. Holtzer and incorporated in 1889. It has experienced a steady, healthy and continuous development, from the early days before the telephone was invented, when the demand for electrical apparatus was very limited. During these early days the manufacturing was confined chiefly to house and hotel annunciators, bells, batteries, etc.

The advent of the telephone opened up a new field, the possibilities of which the company was not slow to recognize. This telephone business was further augmented after the company commenced the manufacture of power apparatus for telephone



New Factory of the Holtzer-Cabot Electric Co.

work. Today Holtzer-Cabot motor generators figure largely in the power equipment of many of the large telephone exchanges, not only throughout this country but in foreign exchanges as well.

The increase of business and development in the motor line

necessitated, several years ago, the leasing of a large factory building in Boston, which was soon taxed to its utmost capacity, and additional premises had to be secured. The new factory admits of consolidating the several plants, and by combining these will effect a large saving and result in increased efficiency in every way.

The Goheen Pole Hole Digger.

The Goheen pole hole digger attracted much attention at the Illinois state fair and also at the St. Louis fair, at which demonstrations were made. Many of those who saw the digger in operation pronounced it far ahead of anything along the same line that they had ever seen before. A number of orders were also taken at both fairs.

Use of the Goheen Pole Digger in Setting Poles.

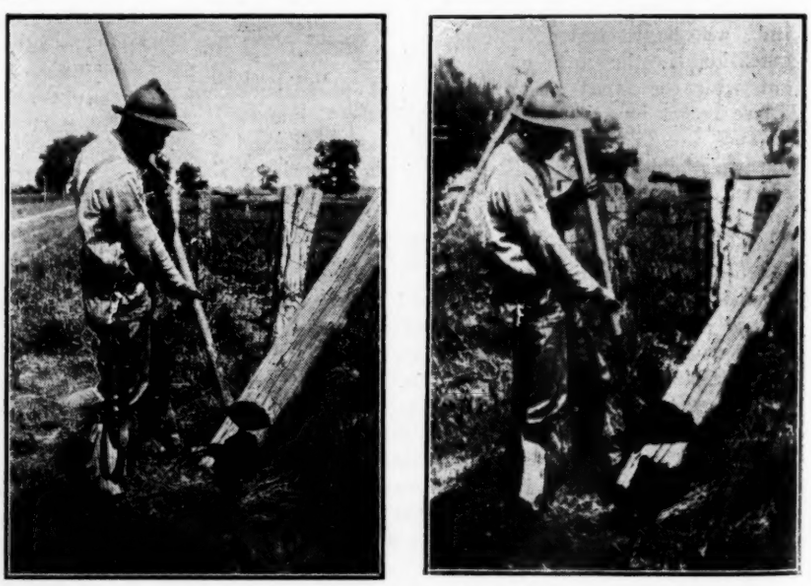
The Triple Tool Co., Jacksonville, Ill., manufacturer of the Goheen digger, states that of the shovels sold the majority of the users are well pleased with them and it has also found that the more the Goheen digger is used the better it is liked. One customer who has used the Goheen diggers for a number of weeks, states that he never again expects to do without them.

The Goheen pole hole digger is in use in practically all of the Central states according to F. J. Blackburn, treasurer and general manager of the company, and several of them have been shipped as far as the coast.

The digger consists in the main of a straight wooden handle, ferrule, one leaf spring and a steel blade. Near the upper end of the blade is attached a case hardened eye so constructed that it has three flat surfaces for the pressure of the spring which rests in the ferrule and bears upon this eye. The blade is thus held in rigidly in three positions: 1, in a perpendicular position for cutting the dirt loose; 2, in the position of a right angle for removing the dirt from the hole; 3, at an acute angle for filling purposes, or for use as a digging tool.

Close to the upper end of the spring the ferrule is pierced by a set screw which is used in giving the desired tension.

In the accompanying illustrations are shown the old method of digging pole holes with the spoon shovel and the new method by means of the Goheen digger.



Old Method of Digging Pole Holes.—New Method, Using the Goheen Digger.

Descriptive literature and further particulars relative to the Goheen pole hole digger may be obtained upon request.

Nungesser Battery Receives High Endorsement.

The Nungesser Carbon & Battery Co., of Cleveland, Ohio, recently received a communication from H. G. Addie, superintendent of the Northern Iowa Telephone Co., Cresco, Iowa, highly endorsing the Nungesser "1900" dry battery. He says:

"Although we have not as yet renewed our contract for the '1900' battery, we intend to do so as we can see no reason for changing to any other kind of battery. We might say that we have used the '1900' practically all of the time for 16 years and although we have occasionally tried out or tested some other kinds, we have invariably had to come back to the old reliable '1900' as being the most reliable and 'cheapest in the long run' battery for us to use."

Stromberg-Carlson Free Advertising Service.

The Stromberg-Carlson Telephone Mfg. Co., of Rochester, N. Y., has prepared an attractive post card in colors showing a girl using the Combination Phone. The company states it will furnish quantities of these cards to the trade with the name of the telephone company imprinted on the face of the card, provided for writing.

A supply of these cards may be obtained, by any telephone company, upon application to the Stromberg-Carlson company's advertising department on a letter head bearing the telephone company's name.

Paragraphs.

Page & Hill Co., of Minneapolis, Minn., announces the opening of its Chicago office at 19 South La Salle street, under the management of E. C. Stockdale. Mr. Stockdale was formerly connected with the Stone & Webster Engineering Corporation, having been identified with the Keokuk Hydro-Electric development and other of its projects.

New Ottawa, Kan., Exchange Nearing Completion.

Work is being rapidly pushed to completion on the new exchange of the Kansas Telephone Co., at Ottawa, Kan., which is to consolidate the plants of the Kansas City Long Distance Telephone Co. and the Missouri & Kansas Telephone Co. in that city. The plants are being operated separately, under authority of the commission, until the new exchange is completed. The new plant will cost approximately $75,000. W. P. Hemphill is owner and manager of the company, and W. C. Polk is the engineer in charge of the reconstruction and consolidation.

Out of the Mail Bag

Some more or less cynical party has paraphrased Whittier's "Maud Muller", and in substance declared that of all good words of tongue or pen the sweetest are: "Enclosed find check." There is some truth to the statement, but how much more pleasant are those magic syllables when followed by a friendly message to the effect that the signer of the check is glad to send it to you because he feels you are helping him in his work!

TELEPHONY receives many such tokens of friendship. In fact, instead of the curt request "Receipt and return," more often the remitter takes the time to write a line expressing his satisfaction with the paper and his gratitude for the benefit he has received in reading it from week to week. For instance: C. J. Vowles, general manager of the Pomona Valley Telephone Co., Edgeley, N. Dak., writes:

"Enclosed find our check to pay our subscription to TELEPHONY for another year. We think a great deal of your publication and are pleased to renew our subscription."

In a letter enclosing remittance for his subscription, E. D. Selmser, Houston, Texas, says: "Your magazine is getting better every issue. I used to think it could not be improved, but my 'think' was wrong. Your high grade articles—technical and financial—are fine. Kelsey, Edwards, Shoemaker and Mitchell are surely doing their part, and I hope they will keep it up."

William F. Rath, of the Michigan State Telephone Co., Detroit, sends in his check for another year and adds: "I surely got my money's worth from TELEPHONY's Home Study Course."

B. R. Shulze, La Plata, Mo., in a letter enclosing his subscription remittance says: "Many thanks for not delaying my paper, as I could not get along without it."

A. W. Field, Detroit, Mich., remitting for TELEPHONY, says: "Owing to my being in Detroit at school and learning, also, the automobile business, I thought at first I would not continue to take your paper. But after considering the true value of the Home Study Course and its efficiency, I gladly renew my subscription. As for the magazine itself, I cannot say enough for it, and certainly every telephone man should read it regularly."

Allen Chase, manager of the United Telephone Co., Belton, Texas, in remitting for his subscription, adds: "Have not been able to get more than a small part of all the good that is in your publication because of lack of time for study at present, but have obtained a great big money's worth for all that, and hope I will never again have to be without it."

"We have been much interested in your magazine for some time," writes A. J. Reynolds, secretary and treasurer of the Home Telephone Co. at Quincy, Wash., in a letter enclosing remittance for subscription. "No telephone company can afford to be without TELEPHONY."

Albert Schuler, general manager of the Home Telephone & Telegraph Co., Santa Barbara, Calif., is a good fisherman as well as boss of a telephone exchange. The accompanying illustration shows Mr. Schuler looking over a mess of mountain and rainbow trout. In an explanatory note, Manager Schuler says: "All work and no play is not good for the system, so we have to give the system a little medicine once in a while. The photograph shows the results of two hours' fishing after walking ten miles over the mountains to get there."

Houck McHenry, secretary and treasurer of the Capital Telephone Co. at Jefferson, Mo., one of the leading Independent telephone men of the Middle West, in a letter to Mr. Kelsey recently, said: "Your article in TELEPHONY for September 25 was, in my opinion, a message. Telephony is out of its swaddling clothes, and we are Independent or not, just in proportion as our business is a financial success. Your definitions of the Independent telephone men are true, albeit some may not recognize or appreciate them. It was a splendid article and worthy of its author, and still, as a preface, said author 'had nothing to say,' and 'the forms were yawning for this copy.'

"We are, indeed, a sensitive bunch. Some of us can feel the point of a pin if the hammer is heavy enough. More power to your pen, oh, Kelsey! Tell us the truth as you see it, for 'ye shall seek the truth, and the truth will make you free'—and, incidentally, Independent."

A Two Hours' Catch of Trout by a California Manager.

H. M. Hart, electrical engineer, Signal Corps, United States Army, in the Panama Canal Zone, in a letter enclosing money order for a subscription, says: "A copy of TELEPHONY has come to the undersigned, and has made a very good impression."

In a letter enclosing remittance for subscription, C. H. Harris, manager and treasurer of the Mutual Telephone Co., of Okeene, Okeene, Okla., says: "I appreciate your keeping the journal coming to me. I have been getting TELEPHONY every week since it became a weekly, and I think I was on the list when it was a monthly journal. I can say truthfully, it is a technical education within itself if studied. No one could fail to get much more benefit than he pays for from your publication."

E. E. St. Clair, Downing, Mo., tacked the following pleasant message to a draft for another year's subscription: "Of course, we want TELEPHONY. Every telephone man needs it. Your reading courses have made TELEPHONY of special value both to the executive and the plant man."

"Enclosed find my check for my subscription to TELEPHONY," writes C. R. Claussen, manager of the Rib Lake (Wis.) Telephone Co. "I like the paper very much and assure you that I get value received for my money."

John W. Cull, secretary of the Salamonia (Ind.) Telephone Co., writes: "Please find enclosed money for another year's subscription to your most valued telephone journal. I always look for Kelsey's articles the very first thing. Then there are also many other features well worth the price to any one engaged in the telephone business."

J. B. Forster, of the Northwestern Telephone Exchange Co., at Granite Falls, Minn., in writing in for a change of address, adds: "As I am wire chief now, I couldn't get along without TELEPHONY."

Some Interesting Data Relative to Blasting Pole Holes

Instructions in Blasting Pole Holes by Means of Dynamite—Methods of Loading for Blasting Holes of Various Depths and in Different Kinds of Ground—Abstract of Booklet Published by the E. I. Du Pont De Nemours Co.

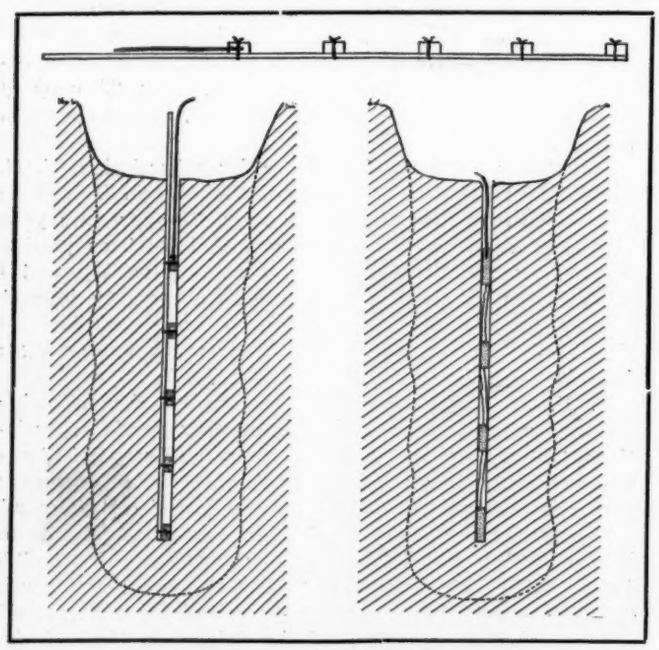
Pole hole digging by hand labor, as all telephone men have experienced, is laborious work, especially in hard ground. The cost of hole digging, of course, depends upon the nature of the ground. When soft, easy digging is encountered for the full depth of the hole, little improvement can be made over the old method. But when tight clay, hard pan, shale or rock is encountered a rational use of explosives will both hasten and cheapen the work.

In a booklet on "Blasting Pole and Post Holes," the E. I. Du Pont De Nemours Co., of Wilmington, Dela., gives some interesting data and instructions for blasting holes by means of dynamite.

When hard ground is encountered and the location of the hole determined, the shovelers should first remove the soft surface to a depth of from 6 to 8 inches, or down to the hard ground, and to the full diameter of the desired hole. This will prove helpful even where there is but a few inches of soft ground. The hole is then ready for punching the bore hole for loading.

The bore hole is a small hole made for loading the explosive and should be located in the center of the shallow hole already shoveled out. This bore hole should be 1½ inches in diameter. Where deep holes are needed it should be 2 inches in diameter, as there must be room for loading the long charge of dynamite.

The method of punching the bore hole depends on the nature of the ground. In clay it may be easily put down by means of a long churn drill, using a little water. For harder ground a heavy drive point or drill can be driven down and



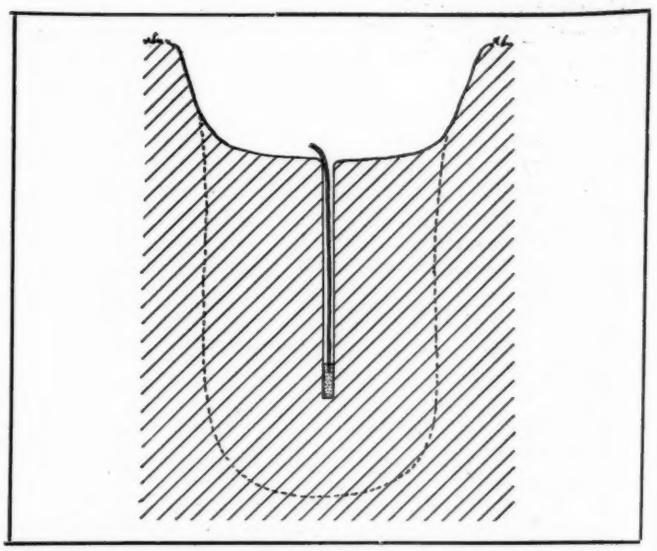
Charges Tied to Stick—Methods of Loading.

loosened by pounding on the sides, so that it can be easily removed.

The use of a soil auger is often required for finishing the bottoms of very deep holes where churn drilling or punching is difficult.

Holes can be made entirely by the use of the auger, but this is usually more expensive than punching. When the soil is too dry to stick to the auger, a little water should be poured into the hole. This forms mud that can be easily lifted out. Hard shale and rock require the use of rock drills.

Shallow holes are ordinarily blasted by using a half, or,



Loading for a Shallow Hole.

if the ground is very hard, a whole cartridge of Red Cross farm powder, Du Pont Quarry powder, Red Cross stumping powder or 20 per cent. to 40 per cent. Red Cross Extra. This is primed and loaded in the bottom of the bore hole, usually without tamping. Either cap and fuse or electric blasting caps may be used.

The effect of such a blast is to force back the soil and form a "pot hole" at the bottom, and loosen the soil above so that it may be easily spooned out. This avoids the necessity for using a chisel or other tool to loosen the hard ground.

The greater part of the ground is packed back into the wall and bottom, especially if it is wet or moist when the blasting is done. Some loose soil is usually left at the bottom of the hole.

The method of loading must be changed for deep holes, or else a tight bridge or plug of dirt will be left at the top. To prevent this, the charge must be distributed along the hole.

This distribution may be made in three different ways:

METHOD A: Use a straight, narrow lath, reed, or stick, as long as the hole is to be deep. Cut the cartridges into two or three pieces. Tie one piece of dynamite to the side of the stick at one end; from 6 to 10 inches farther up tie a second piece. Continue this to within 12 to 18 inches of the top, where a half cartridge primer is used.

The charge thus arranged is placed, with the primer end up, into the hole, and fired. Tamping is seldom required.

METHOD B: Space the pieces of cartridge as has been described, on the edge of a sheet of heavy wrapping paper, with the primer at one end. Roll into a long cylinder or rod, and fasten the dynamite with pins stuck through from the outside. This method is not generally considered so satisfactory as method "A," as the paper cylinders may be hard to make, or may give trouble in the wind. The loaded cylinder is placed

in the hole in exactly the same manner as the charge tied to a lath.

METHOD C: When neither straight laths nor wrapping paper are obtainable, good loading can be accomplished by dropping the desired fraction of a cartridge to the bottom of the hole. On this drop and press into place with the tamping stick, one or more small sticks or strong weeds broken to the length to which it is desirable to space the next charge. Place the second charge and repeat, using more short sticks, until the primer is needed. The sticks must not be large enough to fill the hole.

Care must be exercised to see that the sticks do not slip past the dynamite and that the dynamite rests on the top of the stick.

This method can often be used to good advantage in isolated places where the material for the other methods is hard to obtain.

No matter which method is used, care must be exercised to see that the space between the charges is not plugged up, as the lower charges are exploded by the shock of the top charge or primer. The presence of a plug or of tamping between the charges may be sufficient to blanket off this shock and leave the bottom charges unexploded.

The explosive recommended is Red Cross Extra, 40 per cent. or stronger. In warm weather Du Pont straight, 40 per cent. or stronger, is used to good advantage, as the charges can be spaced farther apart, and there is a reduction in the slight danger of misfires and unexploded charges.

The top or soft ground should be shoveled out before blasting, as was recommended for shallow holes. This assists in confining the blast to the desired area.

In a hard clay soil an effort was made to blast 4½-foot pole holes. In the test seven holes were blown. In blasting the holes the cartridges were placed different distances apart. The results were good with but one exception. In that instance the hole was not sufficiently opened at the top and the earth fell in, filling up the hole.

There is no necessity for using an electric blasting cap in connection with this work, but the use of safety matches is suggested for lighting fuse. The fuse need only project two or three inches above the surface, and should be bent to one side. The operator may be within 50 feet of the hole, when the dynamite fires, without danger, as there is no general upheaval of earth.

An ordinary post-hole digger or a spoon shovel is desirable for removing the loose earth. No digging bars are necessary, the earth being well broken. The average time required for cleaning the hole to receive the pole is from five to ten minutes.

The cost of blasting one of these tests holes, including the dynamite, fuse and matches, labor and supervision, was 31⅛ cents and for another 27½ cents. A fair average for the cost of digging a hole by hand is 50 cents.

The total number of holes per day will be greatly increased when dynamite is used. The labor is much less, and the holes may be more firmly set, as the earth about the hole is packed by the explosion, thereby reducing the amount of tamping necessary when the pole is set. Thus indirectly a considerable saving is effected.

Less men are required when dynamite is used. The gang may be made up as follows: Wagon with tools and dynamite; two diggers; one man with flags and dynamite; one digger to trim up hole; one man with fuse and blasting caps. These are followed by the regular pole-raising gang, or they go back and set poles after shooting a given stretch of holes.

The long cartridges are preferably made up before the work begins. If necessary, supplies of them may be distributed at various points. The usual precautions necessary when handling and transporting explosives should be exercised. It is not advisable to cut cartridges of dynamite at the holes as needed, as there is danger of leaving pieces about.

The diggers makes the holes. Two holes behind the diggers comes the "loader," who puts the cartridge in the hole, and places a red flag on top of same.

One hole behind the "loader" comes the "shooter." Every ten holes the "loader" may recover the ten flags taken up by the "shooter."

While it is possible for one man to load and shoot, this is not advisable.

A rule should be that four men comprising the gang should not get out of sight of each other. Such a gang will complete from 30 to 50 holes a day—say a mile of poles per day of 10 hours.

The dynamite method is not only easier than hand digging, but actually costs less. There is practically no danger. Greater progress can be made with the line, especially in hard soils. In the majority of cases, one cartridge of 40 per cent. straight dynamite will do the work.

As the average telephone man is not familiar with handling explosives, clear instructions of a general nature, particularly as to cutting the cartridges, putting in fuse, and loading should be given by the foreman.

A construction crew who once employs the dynamite method will become an enthusiastic advocate of it and will not readily return to the hand method.

Condensed News Reports

Officers of Companies Are Urgently Requested to Forward to Us Promptly All Financial and Other Statements as Soon as Issued and Any Items of Interest as to Their Plants and Systems

Personal.

FRED ORR, of Waukon, Iowa, has been appointed manager of the Standard Telephone Co., at Elkader, Iowa.

TENE BORDERS, of Sharon Grove, Ky., has been appointed manager of the Christian-Todd Telephone Co., at Elkton, Ky., succeeding the late James White.

CARL SPAULDING, manager of the Hartford City office of the United Telephone Co., has been placed in charge of the Montpelier, Ind., office of the company.

E. S. STROUPE, for some time connected with the Citizens Telephone Co., at Lebanon, Ind., has resigned to become manager of the Walkerton Telephone Co., of North Liberty, Ind.

MACK MOFFORD, of Brazil, Ind., has been named general manager for the Bell company at Clinton, Ind., and he will have general charge of the Clinton, Newport and Dana, Ind., exchanges.

HENRY NEUSCHAFFER, has purchased the Butler-Rich Hill Telephone Exchange, at Butler, Mo., from Mrs. Maudelle Reinheimer. Mr. Neuschaffer was formerly manager of the Butler exchange.

JOHN O. BEAM, manager of the York, Pa., office of the Bell Telephone Co. of Pennsylvania, has been promoted to the office of manager of the Reading exchange, succeeding N. B. Wamsher, who resigned recently.

GEORGE K. BLAKELY, district manager of the Northwestern Telephone Exchange Co., at Sioux Falls, S. D., for the past six years, has resigned his position and will become affiliated with the Fish Bake Oven Mfg. Co., of Walworth, Wis., and will make his headquarters in Chicago.

W. A. BAILEY, manager of the Floresville, Texas, exchange of the Southwestern Telegraph & Telephone Co. for the past two and a half years, has been transferred to Llano, where he will have charge of the exchange. J. F. Gowen, of San Antonio, has been named to succeed Mr. Bailey at Floresville.

F. J. GORHAM, manager of the Cumberland Telephone & Telegraph Co.'s office at Henderson, Ky., has declined a trans-

A 1000-Line Addition to Los Angeles'
Automatic System

—which began operating in 1904, and now serves over 66,000 stations, a growth of more than 4000 per year.—

A 600-Line Addition to Honolulu's
Automatic System

—which was first cut-in five years ago with 1800 telephones and now has over 5600 in service.—

Orders Like These Prove That

The Automatic Telephone wins and holds popular favor.

Companies operating Automatic equipment enjoy constant and healthy growth.

Automatic systems built to serve a comparatively few subscribers can easily be enlarged to serve any required number.

The Automatic has done it for others.
The Automatic can do it for you.

Automatic Electric Company
Chicago

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

CONDENSERS

A Word to Makers and Users of Condensers

You want to make, or buy, the most reliable and up-to-date Condenser.
Then use, or specify, Metallized Paper—Mansbridge patent—instead of the old fashioned solid foil.
Condensers made with solid foil break down internally sooner or later, generally **sooner.**

Mansbridge Type Condensers are Self-Sealing and cannot be internally short-circuited. If one is broken down by a lightning or high-tension discharge, or by mechanical damage, it automatically and instantaneously seals up, this being the unique and characteristic property of the metallized paper.
You can drive a pin right through a Mansbridge Condenser and the capacity and insulation will still be O. K.! Sounds impossible, but it's solid fact!
Sample—complete with pin—sent to any skeptic.

Millions—literally millions—of Condensers made from metallized paper—Mansbridge process—are now in use all over the world, and the number of satisfied users increases daily.

Complete Satisfaction

That's the reason why the Mansbridge Condenser has made good.

Mansbridge Condensers are **More Reliable, Lighter, Smaller and no more Costly** than those of the old fashioned solid foil type.

They have been adopted exclusively by the English government Telegraph and Telephone Administrations; and they are made under license by Western Electric Company, Ericsson Mfg. Co., Electric Specialty Co., Stromberg-Carlson Co., American Electric Co., and by numerous other licensees all over the world.

Insist upon having MANSBRIDGE CONDENSERS and save money in first cost, and also in maintenance.

For full particulars and for terms of manufacturing license in U. S. A. and Canada apply:

G. F. MANSBRIDGE, Mount House, New Barnet, England

fer to Louisville by the company and will remain in Henderson. He has been elected trust officer of the Ohio Valley Banking & Trust Co., and has resigned his position with the telephone company. He had been local manager three years, having been associated with the company for several years.

C. G. Beck, district manager of the Southern Bell Telephone & Telegraph Co., at Savannah, Ga., has been promoted to commercial superintendent with headquarters in Savannah. W. S. Henley, manager at Waycross, will succeed Mr. Beck as manager as Savannah. M. E. Brunson, manager at Brunswick, will succeed Mr. Henley as manager at Waycross. T. L. Jordan, chief canvasser, Jacksonville, has been appointed manager at Brunswick. R. E. Brown, of the publicity office in Atlanta, has been appointed chief canvasser at Jacksonville.

F. L. Middleton, on October 1, re-entered the employ of the Texas Telephone Co. after an absence of nearly 15 years. He will act as special agent for the company, covering its entire territory, and his headquarters will be at Waco. Mr. Middleton entered the telephone field over 30 years ago as night operator at Elkhart, Ind., and was identified with the Bell interests for some time. Upon the opening of the Independent field, he organized the Home Telephone Co., of Elkhart. He was prominent in the development of the Independent field in Indiana and also at Waco, Texas, in the late nineties. Later he was identified in various capacities, with the Chicago Telephone Supply Co., the Stromberg-Carlson Telephone Mfg. Co., the International Telephone Mfg. Co., the Automatic Electric Co., and the North Electric Co.

New Companies and Incorporations.

Oakville, Ia.—The Oakville Telephone Co. has been organized with a capital stock of $20,000. The incorporators are Benjamin Miller, M. E. Daubendiek and W. H. Daubendiek.

Hamblin, Mont.—The People's Telephone Co. has been incorporated with a capital stock of $25,000.

Rochester, Minn.—The Farmers Telephone Co. has been incorporated with a capital stock of $2,000. The incorporators are Elmer Dodge, O. Pike and S. B. Shongo.

Messick, Va.—The Poquoson Telephone Co. has been incorporated, with a capital stock of $5,000. The incorporators are F. A. Sinclair, L. C. Riggins, L. H. Hogge, C. L. Moore, J. R. Moore, H. T. Forrest and G. W. Amory.

Construction.

Cuthbert, Ga.—The Southern Telephone Co. is reconstructing part of its toll circuits, and improving its other lines preparatory to future development.

Lancaster, Ky.—The Bastin Telephone Co. will shortly convert its lines to metallic circuits.

Superior, Wis.—Officials of the Wisconsin Telephone Co. have approved an appropriation of $200,000, to be spent in reconstructing the Superior plant

Elections.

Jacksonville, Ill.—At the annual meeting of the stockholders of the Illinois Telephone Co. the following directors were elected: S. E. Simpson, Carrollton, Ill.; C. T. Metcalf, Greenfield; C. Riggs Taylor, Jacksonville. The directors, immediately after the adjournment of the stockholders' meeting, held their annual meeting and elected the following officers for the ensuing year: President, W. W. Holliday; vice-president, E. P. Kirby; treasurer, W. W. Ewing; secretary and auditor, H. A. Withee. W. W. Holliday was re-elected general manager. A 3 per cent. semi-annual dividend was declared, payable November 18.

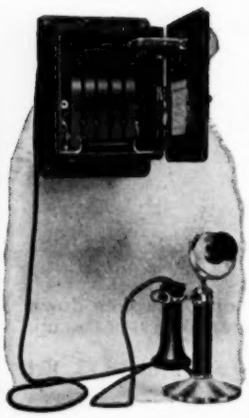
Reddington, Ind.—The stockholders of the Reddington Telephone Co. elected Henry Hohenstreiter manager; A. F. Biddle, treasurer; Ed. Talley, William Swengle and Valentine Hunt, directors.

Prescott, Ia.—The Prescott Mutual Telephone Co. has elected the following officers: Jas. Vanosek, president; C. McIlravy, vice-president; Jacob Lahr, secretary; and F. A. Outhier, treasurer.

Miscellaneous.

Burkesville, Ky.—The exchange building and plant of the Gainsboro Telephone Co. were destroyed in the recent fire which destroyed about half of the business part of the city, with a loss of about $30,000.

Moravia, Ia.—Lon Dunn, of Milo, has disposed of his holdings in the Moravia Telephone Exchange to G. W. Leyda, of Oxford Junction, Ia., who becomes sole owner and manager.



Andrae

Desk Set

ANDRAE Desk Sets typify the highest peak of perfected Mechanical Construction ever attained. To install them is to install absolute satisfaction because you install a desk set from which all trouble points have been eliminated.

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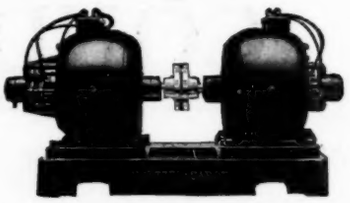

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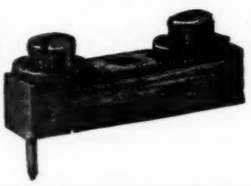

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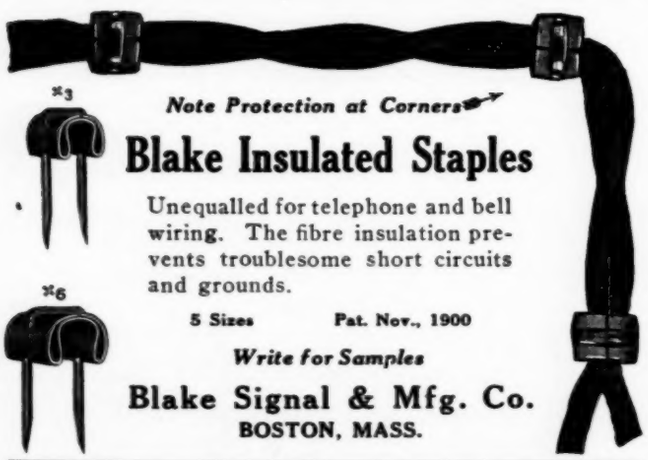

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